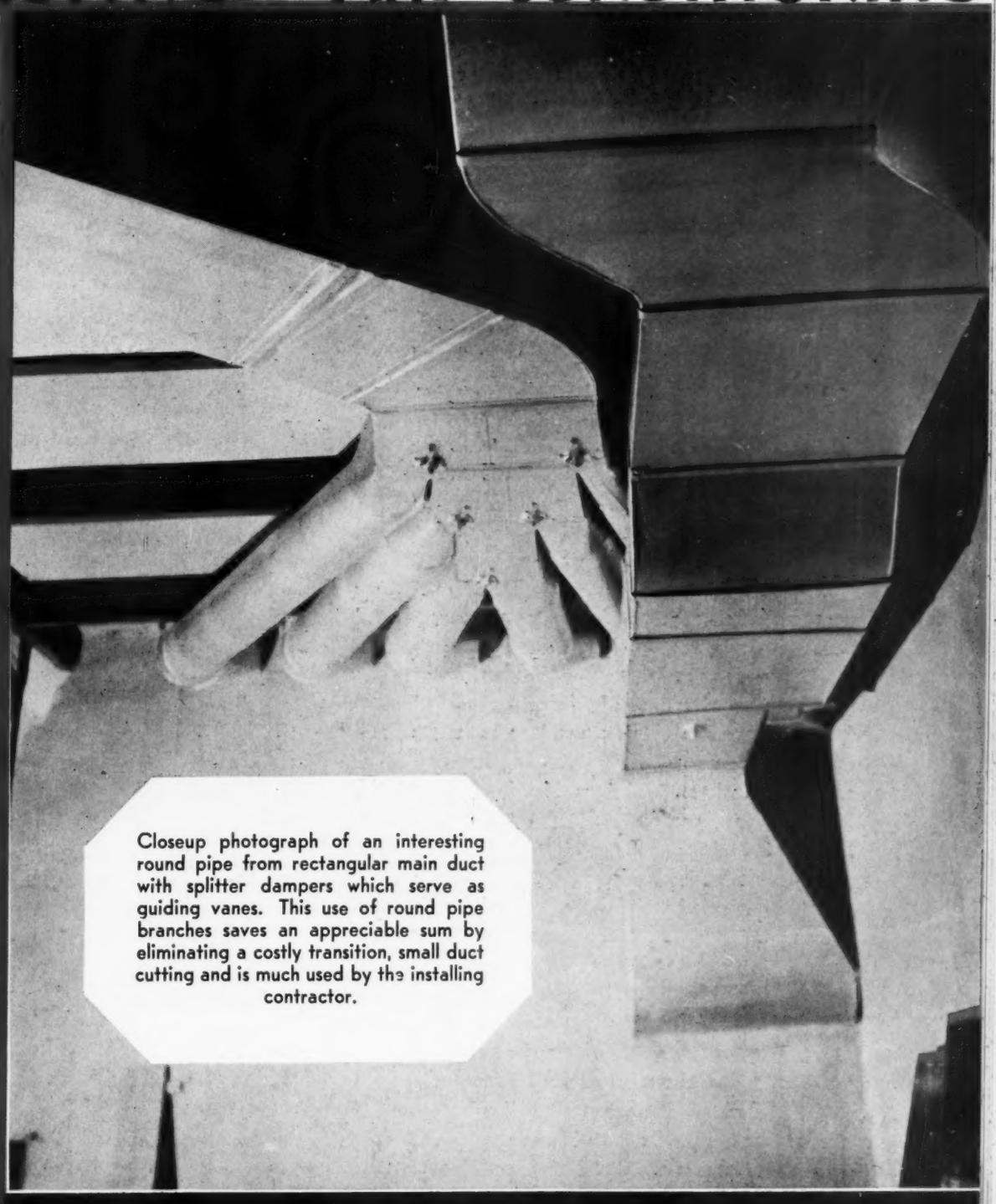
AMERICAN ARTISAN

VARM AIR HEATING • SHEET METAL
ONTRACTING • AIR CONDITIONING



Closeup photograph of an interesting round pipe from rectangular main duct with splitter dampers which serve as guiding vanes. This use of round pipe branches saves an appreciable sum by eliminating a costly transition, small duct cutting and is much used by the installing contractor.

ABLISHED
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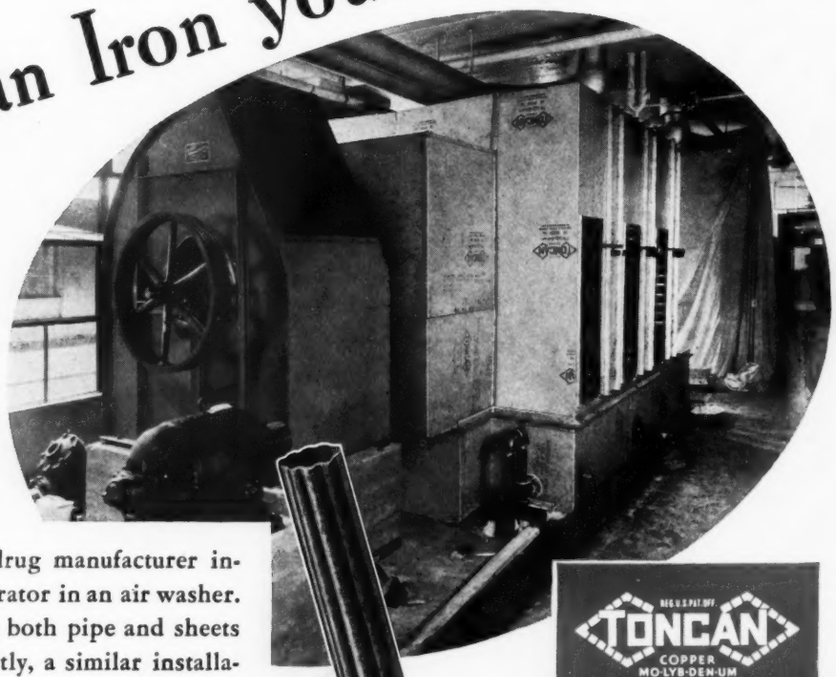
CTOBER
935

THE AIR CONDITIONING SECTION

Make the performance of Toncan Iron your best salesman



Five years ago, a large drug manufacturer installed an ammonia evaporator in an air washer. The material selected for both pipe and sheets was Toncan Iron. Recently, a similar installation was needed in the same plant. The performance of Toncan Iron during the last five years caused it to be specified for the new unit.

There's a lesson here for sheet metal contractors. Whether you do industrial or general building work, you can put Toncan Iron to work on your sales force. You can send it out through your territory and let it build good-will for your company. You can use it as insurance of future business. And it will bring in repeat orders, because Toncan Iron makes no promises that it cannot fulfill.

Toncan Iron is an alloy of refined open hearth iron, copper and molybdenum. It resists corrosion. It works so easily that it is a definite time saver. And it is stocked in plain and corrugated sheets, strip, roofing of various types, nails, tacks, bolts, nuts and rivets. For welding, rod of the same analysis is available.

"The Path to Permanence" will give you definite ideas about where Toncan Iron will help you to obtain additional business. A copy will be sent to you upon request.

REPUBLIC STEEL

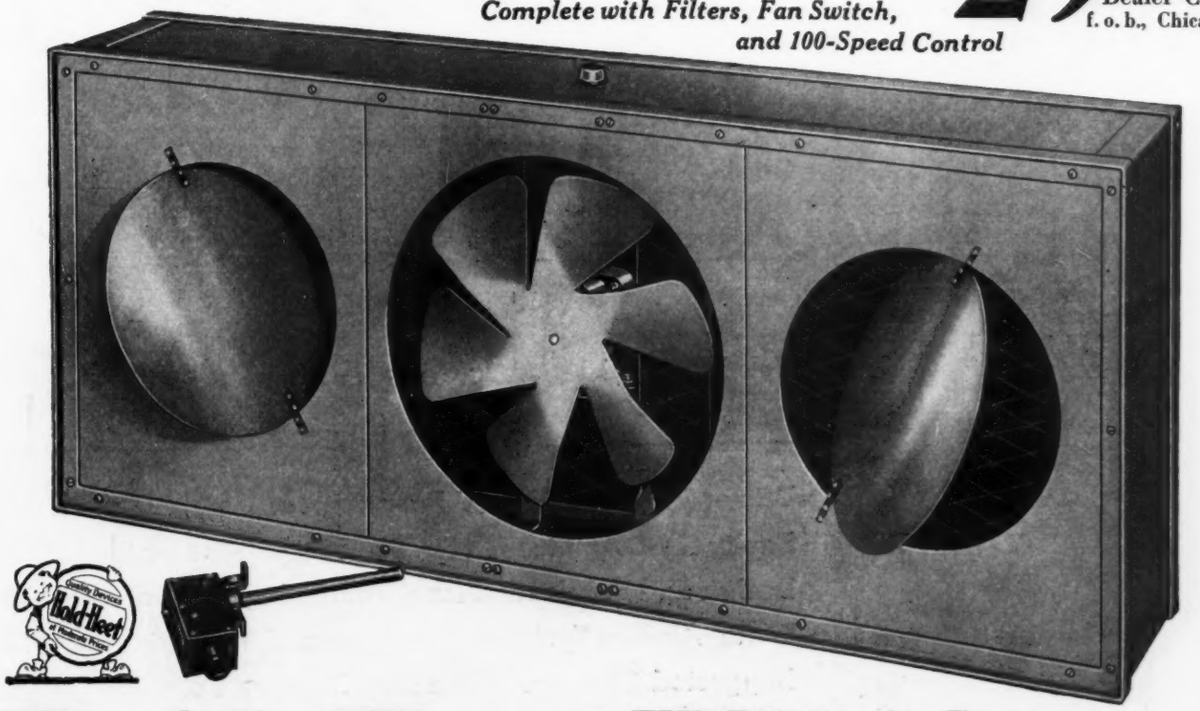
Republic Steel
CORPORATION

GENERAL OFFICES · · · YOUNGSTOWN, OHIO

HERE is the "volume-sales" unit you have been looking for . . .

$29.75 Dealer Cost f. o. b., Chicago

Complete with Filters, Fan Switch, and 100-Speed Control



Hold-Heet
Air-Conditioning
Booster

Again Hold-Heet leads with everything . . . Price, Quality, Capacity, Design

Compare Specifications

The standard unit at the price shown includes all of the equipment listed below. Here are the guaranteed specifications:

1. 100 speed control—simply turn the knob on top of the cabinet. Vary delivery to match requirements of the job.
2. No. 3AF Hold-Heet Rod and Tube line voltage 15 ampere fan switch.
3. Ballentine 1/12 H. P. Direct Connected Shaded Pole Motor cushioned in rubber.
4. 14-in. fan—new quiet type with large area at the tips where it counts most. Gives greater delivery than 16-in. fan of conventional design, yet is far more quiet because of lower tip speeds.
5. 1000 sq. in. of filter area; a 20"x20" and a 20"x30". Effective viscous coated Hold-Heet Filters of the throw-away type are employed.
6. Substantial construction—rigid angle iron frame both front and back—easy to hook up. May be installed either with or without piped cold air return.
7. Cabinet 50"x21"x0½"—comes completely assembled, attractively finished in gray enamel.
8. Fan deliveries at 1450 r.p.m., 1400 c.f.m. at .04", 1040 c.f.m. at .12".
   Fan deliveries at 1000 r.p.m., 800 c.f.m. at .04".
9. Weight 75 lbs. This is a large, substantial, adequate piece of equipment—superior to any other booster you have ever seen.
10. Ample by-passes for gravity circulation—Two—12 inch diameter.
11. Coordinated performance—every part of this equipment is built complete by HOLD-HEET, motor—fan—filters—fan switch—cabinet. These matched units give performance results that have never been equalled. There is only one moderate manufacturing profit in the entire job—hence the enormous value.

Russell Electric Co., *Mfrs.*, 342 W. Huron St. CHICAGO, U. S. A.

EVERY Gravity Furnace Needs Fans and Filters to be Modern

This quality equipment is offered at a price within the reach of all home owners. Every gravity installation is "crying" for this unit. It forces heat through all of those long runs regardless of wind direction. It will cure those hard-to-heat places. It will provide positive ventilation and circulation and it will effect substantial savings in the fuel bill. Forced circulation enables more efficient heat transfer by reducing bonnet temperatures (less heat goes up the stack). It is no longer necessary to force the heating plant excessively—wasting a lot of fuel in order to force heat to the more remote rooms.

The Fan Sells the Men — the Filters Sell the Women

Until they have an installation the home owner will never realize how much filters add to home comfort. They remove the circulating dust and dirt and catch the germs that "ride the dust particles". The substantial savings in dusting and housework, cleaning and decorating costs are very much worth while.

Use The Coupon . . . Order Your Sample Today

Get started with this money maker. The time is fast approaching when every furnace will have a blower or a booster. You know equipment of the outstanding specifications and price we are offering can be sold in your territory in almost unlimited volume. You will never realize how "good" this proposition really is until you get your sample.

Read Order Form Carefully

Who but HOLD-HEET would ever dare make such an offer? Here is the biggest money making opportunity in the entire furnace field.

Russell Electric Co.
342 W. Huron St., Chicago

PIN THIS COUPON TO YOUR LETTERHEAD

Please ship me at once.....Catalog No. DF1 Hold-Heet Boosters @ my f.o.b. Chicago dealer cost of $29.75. Check or Money Order for.....enclosed.

NOTE: This order is given with the full understanding that these units are exactly as described; further, that this equipment can be returned within 30 days if not entirely satisfactory and the full purchase price plus transportation costs will be immediately refunded.

Signed .....

Firm Name .....

City ..... State.....

If preferred this order may be placed through your regular jobber.

IN THIS ISSUE

The roof of the Senate Office Building, Washington, stayed put for 26 years. Then it began to come loose. Hasty reconstruction was necessary. The contractor, on page 14, tells how he laid a tear-proof roof in hurry-up time.

*

The Charles Hartman Company, New York, has done many interesting ventilating jobs. One of their recent installations is reported on page 16. Especially interesting is the method of laying out every duct section.

*

As works picks up it is fairly certain that contracts for heating, ventilating and air conditioning schools, factories, halls, churches will come up for bid. Many such jobs can be done by our readers if they understand the principles and equipment of warm air-fan systems of heating and ventilating. Platte Overton begins the first of a series on page 18.

*

With winter air conditioning coming into full swing, we will have to give consideration to humidity. Humidity, in turn, is inseparably tied up with temperature. An article on page 27 explains the relationship.

*

The Trask Co., in Boston, has worked out some interesting installation methods for remodeled jobs where stacks are something to dream about. They use round pipe branches, also, with good results. On page 28, we report their activities.

*

Remember the article by Donald Kroeker on air temperature drop in ducts? N. C. Ebaugh, on page 30, arrives at practically the same results mathematically. He also develops a chart which shows the drop for all sizes and lengths of pipe.

*

S. Konzo, on page 32, asks himself some questions on how, where and why to take pressure drop readings in forced air systems. If you have been wanting to try out some resistance tests, but haven't known just how to go about it, this article will tell you just how to proceed.

*

Ever hear of Effective Temperature? Do you know how it came into being and what it really means? Turn to page 34 and find how the chart was established, why it is important, and how you can use it in your daily work.

AMERICAN ARTISAN

With which is merged

FURNACES and SHEET METALS AND Warm-Air Heating

Covering All Activities in

Gravity Warm Air Heating — Forced Warm Air Heating
Sheet Metal Contracting — Ventilating
Air Conditioning

J. D. Wilder, Editor

Vol. 104, No. 10 — October, 1935 — Founded 1880

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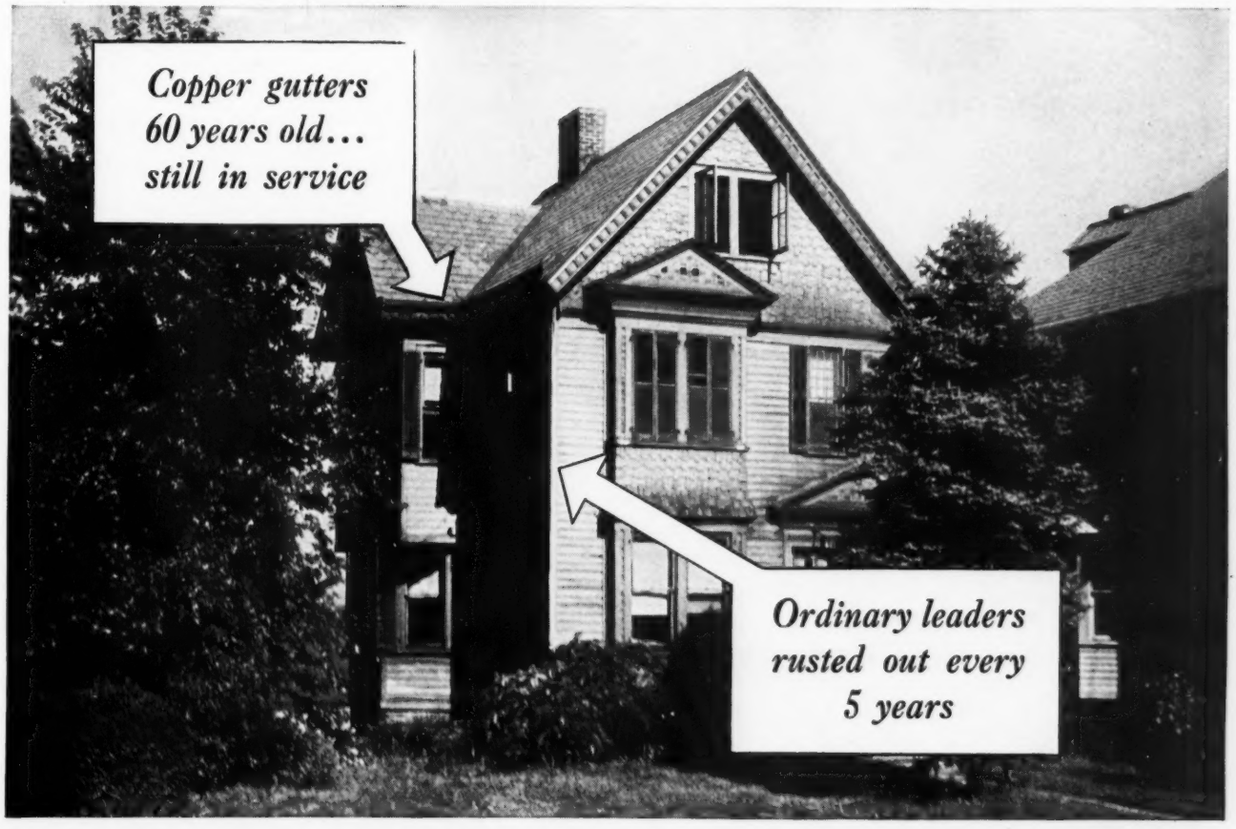
More than 7,000 Copies of this Issue are being distributed

Sales come easier when you *offer known value*



THIS 60-year-old house in Passaic, New Jersey, proves again the durability of copper sheet metal work. The copper gutters have served for 60 years. During that period, twelve sets of ordinary leaders rusted away!

Copper assures the home-owner better value ...complete freedom from all repair expense due to rust. That's one reason why it's easier to sell Anaconda Copper. Another reason is the general acceptance of this brand as the standard of sheet metal quality. Leading sheet metal supply houses carry Anaconda Copper in sheets and rolls, and copper gutters, leaders, elbows and shoes trade-marked ANACONDA.

• • •

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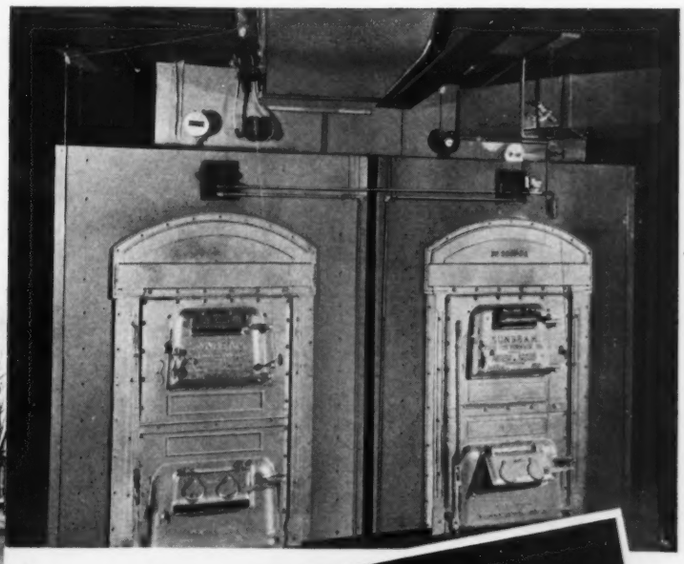


SUNBEAM DEALERS make sales like this

You can now make sales to churches, stores, schools, shops and similar buildings with the Sunbeam Air Conditioning Unit! This latest development in air heating equipment greatly increases your market. You are no longer restricted to the residential field.

The West Side Moravian Church of Bethlehem, Penna., which is illustrated above, is typical of the larger buildings which are now being equipped with Sunbeam Air Conditioners. The two No. 3460 Sunbeam Units shown above were sold and installed by the Wetzel Roofing Company of Bethlehem. The heating requirements of this church are 311,823 Btu (a 24" fire pot gravity furnace has an approximate rating of 80,000 Btu). Besides two large air conditioning units with blowers, motors, filters, the sale included complete temperature and humidifying equipment, thermostat, fan switches, limit switches, and humidistat.

This equipment was ordered through the Sunbeam jobber, Frederick Sabin & Co., Inc., of Philadelphia.

Sunbeam dealers continue to sell their share of gravity furnaces for cottages, small and large residences, and smaller buildings. Air conditioning sales represent new business which these dealers could not handle in past years.

The Complete Line of Heating And Air Conditioning Equipment

In the Sunbeam line, the warm air heating dealer can obtain any type or size of unit that he needs .... pipe and pipeless furnaces .... cast iron and steel furnaces .... sizes from 18" to 34" .... for any fuel, coal, oil or gas .... 6 different types of air conditioning units.

The Sunbeam Financing Plan in connection with Federal Housing Administration makes this equipment easier to sell —provides home owners with the money to purchase, on the most reasonable terms in history. The coupon will bring you the whole story. Sign it and return it. Don't delay.

More Furnace Dealers Sell

SUNBEAM
WARM AIR FURNACES AND AIR CONDITIONING UNITS
Than Any Other Kind

The Fox Furnace Co.
Elyria, Ohio

We wish to know more about Sunbeam Furnaces and Air Conditioning Units; the Federal Housing Administration financing plan; and the name of a nearby Sunbeam Jobber who carries a stock of warm air furnaces.

Name .....

Address .....

City and State.....

A-10

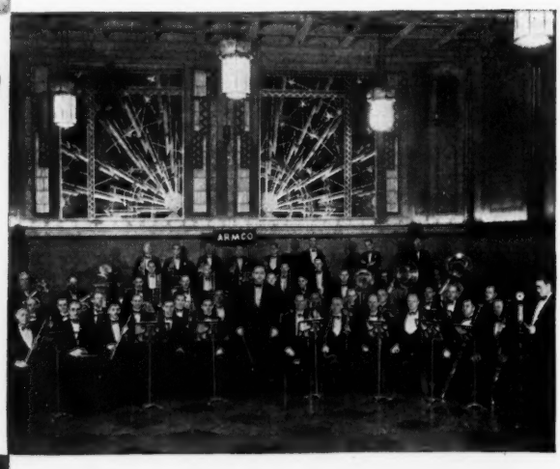
THE FOX FURNACE CO. ELYRIA, O. A DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORP.

FRANK SIMON, CONDUCTOR

THE ARMCO IRONMASTER

Strike up the Band

THE FAMOUS ARMCO BAND



WJZ New York	WSYR Syracuse	WENR Chicago
WBZ Boston	WHAM Rochester	KWK St. Louis
WBZA Springfield, Mass.	KDKA Pittsburgh	WMT Cedar Rapids Waterloo
WFIL Philadelphia	WGAR Cleveland	KSO Des Moines
WBAL Baltimore	WXYZ Detroit	KOIL Omaha Council Bluffs
WMAL Washington, D. C.	WLW Cincinnati	WREN Kansas City

At 10:30 Eastern Time on the evening of October 28, Conductor Frank Simon will lift his baton . . . Another series of Armco Ironmaster Broadcasts will be underway over the NBC Blue Network.

Monday nights thereafter will see thousands of family parties enjoying the fine music of radio's most popular band. And that old favorite, the Armco Ironmaster, will be at the "mike" again with his fascinating stories of current industrial developments.

CONTRACTORS who use Armco INGOT IRON and other Armco sheets benefit greatly by the product-acceptance these broadcasts generate. This seventh year of radio broadcasting coupled with fifteen years of advertising in popular national magazines has created a vast reservoir of good will for sheet metal work done with Armco metals. It is almost a buying religion for people to ask, "Is it made of Armco INGOT IRON?" . . . or Armco Stainless, or some other well-known Armco metal. • Listen in to this first Monday-night Armco broadcast on October 28, and judge for yourself what it means to use Armco Iron and Steel sheets—*beyond the good working qualities of the metals themselves.* The American Rolling Mill Company, Executive Offices, 703 Curtis Street, Middletown, Ohio.

ARMCO

The name in iron and steel that millions know

IT TAKES HARD WORK...

... And Moncrief gives you all you need to profit most from your hard work

- A complete line of furnaces, air conditioning units and air conditioning appliances, modern and quality made, to fit any need and any pocket book.
- Construction which makes installations easy, quick and profitable.
- Everything in pipe, fittings and accessories for both gravity and forced air installations.
- A reputation of 38 years building heating equipment.
- An engineering service to help you figure and install jobs properly.
- Effective literature and sales promotion material to multiply your selling efforts.
- A special finance plan which makes it easy to close sales.
- Trade practices which recognize that our dealers must prosper as well as we.

Write for particulars of the Moncrief Plan, and the Moncrief line . . . the straight line to profit.

THE HENRY FURNACE & FOUNDRY CO.
3473 East 49th Street, Cleveland, Ohio

MONCRIEF
FURNACES AND AIR CONDITIONING SYSTEMS

Don't Buy "A PIG IN A POKE"

GENUINE OPEN HEARTH IRON
GOHI
PURE IRON - COPPER ALLOY
REG. U.S. PAT. OFF.

GOHI Pure Iron-Copper Alloy is available in all sizes and gauges. Produced exclusively by The Newport Rolling Mill Company, Newport, Kentucky.

TO buy sheet metal without definite knowledge of what you are getting is a pure gamble . . . you're taking big chances! But why gamble, guess or experiment? The outstanding superiorities of GOHI Pure Iron-Copper Alloy have been proven in scores of installations. Use GOHI and decisively defeat the three racketeers of Wear, Weather and Corrosion.

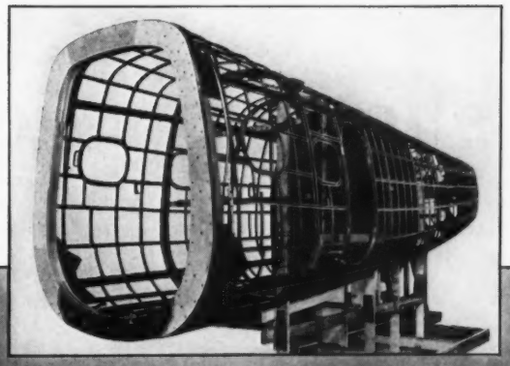
It is the pure iron, alloyed with the right amount of copper, that gives GOHI its unmatched durability; that makes it the longest-lasting, low-cost ferrous metal you can buy. GOHI has demonstrated its rust-resisting qualities through more than a quarter century of service in drainage culverts, probably the most destructive use to which any sheet metal can be subjected. Choose GOHI for permanence.

GOHI SHEET METAL

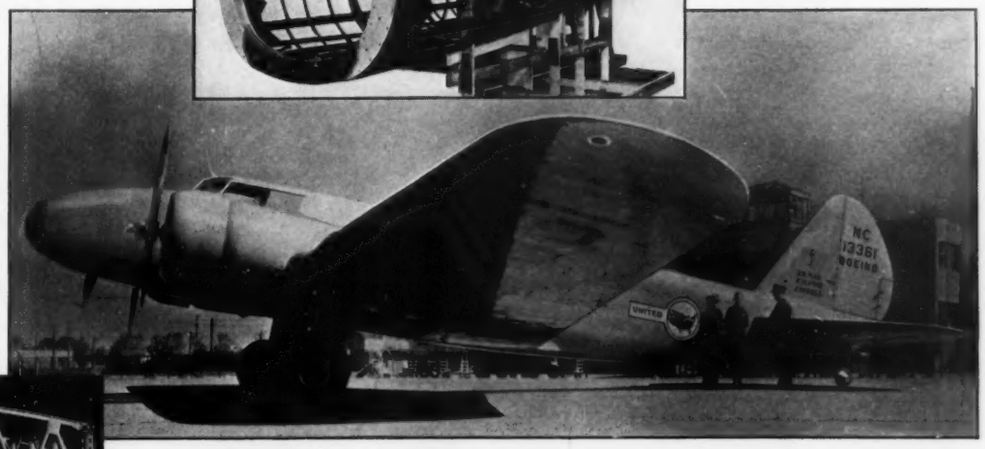
PRONOUNCED "GO-HIGH"

THE NEWPORT ROLLING MILL COMPANY . . . NEWPORT, KENTUCKY

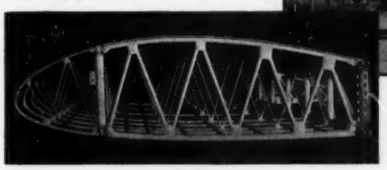
Below:—Stamina for 200 MPH plus—this 1935 model passenger-mail-express transport, fabricated construction throughout, carries 10 passengers, two pilots and stewardess on coast-to-coast hops.



Left:—Showing fabricated inner construction of cabin—the secret of the extreme ruggedness and strength of these new 200 MPH Boeings.



Below:—A cross section showing fabricated construction of wing, designed to withstand a 32 ton load—yet under army test withstood 52 tons before showing any strain.

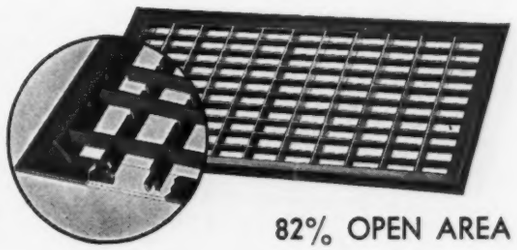


FABRICATED CONSTRUCTION AT ITS BEST

The giant transport ships of today exemplify fabricated construction at its best in transportation.

Independent "Fabrikated" Floor Registers and Cold Air Faces present fabricated construction at its best in their field. Best because they afford the utmost in strength and rigidity, with maximum open area—82% or more.

Besides strength and efficiency, Independent "Fabrikated" construction expresses ultra smartness in modern design and lends itself to the most pleasing finishes and effects. Look to Independent "Fabrikated" for all your register needs.

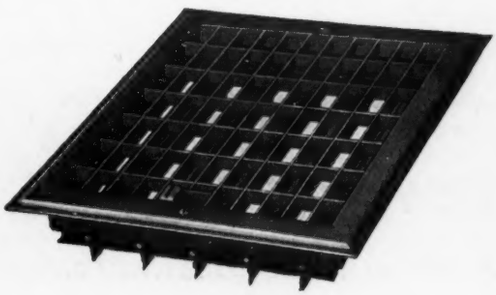


82% OPEN AREA

ANY SIZE . . . . ANY FINISH
Regular or Special

INDEPENDENT REGISTER & MFG. CO.
3741 E. 93d St. Cleveland, Ohio

Send for new Catalogs showing complete line.



INDEPENDENT
"Fabrikated"
(Reg. U. S. Pat. Off.)
FLOOR REGISTERS and COLD AIR FACES

★

He can show you how to throw *his famous "Bender"*

© Wide World

Genuine Sheet Metal Screws guarantee assembly economy!

They *always hold* because the threads run full diameter right to the head. They *always go in easily* because the threads are designed with expert knowledge of the work they must perform, and held to a high degree of uniformity. *Their threads don't strip, nor do the heads twist off* because they are made from a special analysis wire and are hardened by an exclusive process developed from 20 years' experience in making Parker-Kalon Self-tapping Screws.

A star "hurler" makes no secret of the way he grips the ball, the way he lets it go. He'll even show you how. But you won't be able to replace him on the mound. For you'll still lack the thing that really puts the bend in his "benders", the ability that wins ball games. That is his EXPERIENCE! And it comes only from years of practice and specialized training.

In making screws that win savings of time and labor on sheet metal assembly work, *experience*, also, is the real secret of success. This is proved by the uniformly perfect results which genuine Parker-Kalon Sheet Metal Screws give, as distinguished from the uncertain action of imitations that merely "look like" them. Parker-Kalon's specialized experience of more than twenty years in developing and producing Sheet Metal Screws supplies the "extra" quality that wire and machines cannot provide.

Because savings of assembly time and labor depend on uniformly perfect action, specify the name "PARKER-KALON" when you order. Every genuine Sheet Metal Screw in the box is GOOD!

PARKER-KALON CORPORATION
190 Varick Street New York

PARKER-KALON
HARDENED TYPE A SELF-TAPPING
Sheet Metal Screws
PATENTED NO. 1465148

PARKER-KALON PRODUCTS ARE SOLD ONLY BY RECOGNIZED DISTRIBUTORS

Volume 104

No. 10

AMERICAN ARTISAN

Winter Profits

For an industry as new and modern as forced air heating, it is most peculiar that we should have superstitions. Yet it does seem as though the heating fraternity has set up the superstition that mechanical air circulators cannot be sold in the winter time or while the fires are going.

On the very face of the thing it looks silly. What better time to sell a fan to Mr. and Mrs. Smith, who want heat in their back bedrooms and never have had enough to use the rooms? Or what better time than a cold, windy day to talk positive air pressure to Mrs. Jones, who likes her club to lunch in her quiet dining room, but can't use the room whenever the wind comes from the northeast?

Sometimes it almost seems as though industries search for reasons to keep good men off the street and office chairs warm. If ever a season was made for selling fans and blowers, it's the winter time. The colder, the windier—the better. To take heat from any furnace and distribute it evenly and rapidly throughout every room, regardless of the outside weather, is exactly what fans were built for.

Then why not every contractor make a special effort these coming winter weeks to do as one manufacturers' dealers did last winter and sell fans and blowers? Winter is the fan and blower season.

Fools' Paradise

A contractor writes—"Why all the hullabaloo about air conditioning? Why make the thing so mysterious? Why shout so much about the need for knowledge? You seem to be trying to make mountains out of mole holes. Practically every furnace man in our town is installing air conditioning and doing a good job of it, too."

It so happens that we know this writer's town pretty thoroughly. By actual count there are 36 firms doing furnace work listed in the classified telephone directory. Perhaps another dozen have no business phone and probably no business address.

In the last four years we have visited this city frequently and have seen practically every forced air job installed. If space permitted we could cite an example of domestic air conditioning malpractice for all but three contractors in the town.

Here are a few. Contractor number 1—his prize job is a lodge hall (three years old) in which the blower ran backward for three months despite the owner's yells to heaven. Contractor number 2—his "believe it or not" is a pitted blower with filters on two sides. The owner started court action because of excessive electric power bills and then it was discovered that the filters were not matted (they were solid).

Contractor number three—prize job a summer cooling installation using private well water in a domestic size washer. When we visited the job the contractor said, "Mrs. ————, it's true we are not cooling like we should this week, but you understand we have been having some unusually humid weather. Said the owner: "Mr. ————, I thought I bought cooling for just this kind of weather."

One more. Contractor number 4—best known job a house sold as completely air conditioned and so advertised in the newspapers. Actually there is a cast iron furnace, round cased, a paddle wheel blower, two filter cells and three control instruments. The purchaser sued for unethical advertising and collected—handsomely.

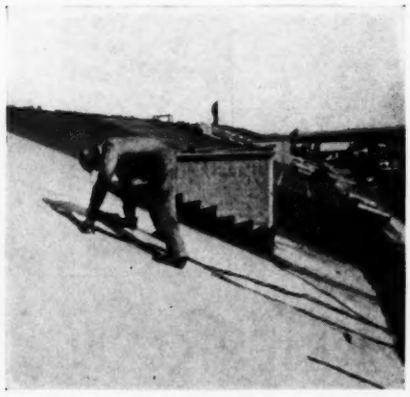
Every one of these "don'ts" are in this contractor's home town and we have seen each job. We could cite at least a dozen equally as horrible.

We make the assertion—if these jobs are typical of the air conditioning systems in the writer's home city (and they are), then the trade in that city doesn't need more technical knowledge—these men need horse sense.

Contractors like this writer seemingly cannot understand or refuse to understand that forced air heating is not air conditioning. It's only a part of air conditioning—the basic phase. The business papers, the manufacturers, the engineers are not trying to ballyhoo air conditioning. Smart people already see that ballyhoo has opened the door to undesirable persons greedy to cash in on a good thing.

Beyond forced air heating is humidification, cleaning, control, vitalization of the air, cooling, dehumidification. Little has been said on these subjects because too large a part of the industry is still up to its ears in forced air heating. Why drown the victim?

Men who refuse to be instructed because they think they know it all; dealers so smug that they cannot see how little real progress has been made—are living in a fools' paradise. These men will awaken about the time some other smarter group has captured the air conditioning market.



Left—View of building from court. Center—Three stages of work; the old roofing in the foreground; center, bare cement slab, background, shows paper in place. Right—Painting cement before applying felt.

Faulty Metal Application on U. S. Senate Office Building Rectified by Unique Methods

By Lawrence E. Gichner
Gichner, Inc.

RECENTLY there was completed in Washington, D. C., on the Senate Office Building a hurry-up sheet metal roofing job large in poundage and likewise highly instructive because it proved that cutting proper sheet metal practices is destructive and expensive.

The office building is 26 years old. Originally covered with standing seam copper, the roof remained weatherproof until last year. Then the sheets began to leave their anchorage. Water trickled through. It dropped on valuable papers. It splashed on U. S. senators. It interrupted business. Temporarily the loose sheets were nailed down, but as fast as one area was made water tight another began to leak.

Inspection showed that, while the copper was just as good as the day it was laid, the installation methods were so faulty that the old roof could not be saved. The inspection also showed that the trouble arose because the copper had been locked by galvanized iron cleats and the cleats had weathered away.

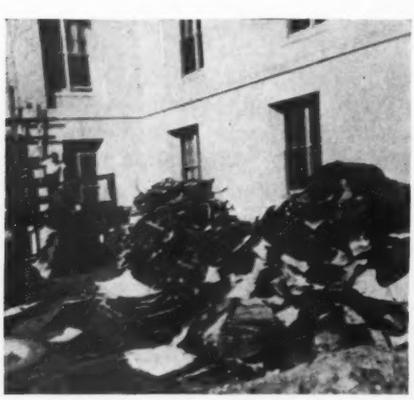
Preparations

Speedily through the corridors of the architect's office a wiry little figure dashed in and out of swinging doors correcting plans and giving final approval to construction details. For "Kelly of the Capitol," as Joshua R. Kelly is familiarly called, is said to know more about the practical application of copper than any man alive.

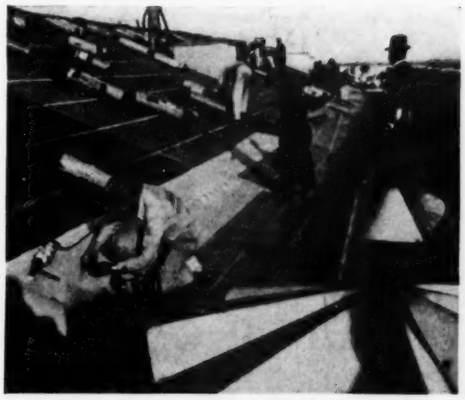
Quickly David Lynn, Architect of the Capitol, appeared before the proper Senate Committee. Congressmen interrogated him as to approximate cost, alterations, interrupting noises, etc. He left their meeting with his suggested appropriation approved, establishing a time record in legislative procedure.

Although Bureau of Standards scientists found the old copper to be in perfect condition, the idea of using the old metal was disapproved because it brought the battens too close together to be architecturally pleasing. Also, the architects did not want standing seams.

"Standing seam is no good for copper. Batten type is the best there is for copper roofing," commented Kelly. So the new roof would be batten type with innovations.



Left—Old copper in courtyard. Center—Drilling holes for battens. Note depth template. Man in rear is blowing dust out of hole. Right—Every hole had to be blown out before anchor bolt would hold.



Left—Laying top felt and copper in the valley. Note wide expanse of copper. Center—Screwing down the battens to which the cleats were previously attached. Right—Opening seams in old copper. Note several places where copper has no cleats.

The contract for over $45,000 was awarded to our firm.

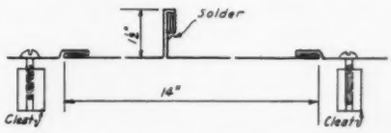
The big problem lay in removing the old and installing the new roof without any damaging leaks. Washington has a climate subject to sudden drenching showers which thoroughly flood everything and tax every drainage system.

To fortify against trouble the gutters and lower decks were installed first, then the slopes, then the flat top decks. Seven crews followed one upon the other. 1. Removing the old copper. 2. Hauling it to the ground. 3. Cleaning the cement slab surface and pointing up cracks. 4. Mopping the surface with cold asphalt coating and laying felt paper. 5. Laying the copper, drilling holes for cleats, cleating. 6. Soldering. 7. Locking the flashing, installing chimney and skylight flashing.

On the batten slopes two additional crews were used—one to form the sheets and another crew of carpenters to fasten down the battens.

Old Copper

The old copper was removed in large sections, rolled, mounted on small trucks, carried to the roof scaffolding and lowered to the ground by the hand pully. The soldered seams were cut off and the large sheets were trimmed and flattened. The seams were shipped to the refineries where the solder was melted off. The copper sheets, being in excellent condition, are being sold today to builders and roofers. The beautiful natural green patina coloring in valleys, flashings and small roofs injects a surprisingly lot of life and spirit into a home. On a number of jobs smart builders have carried the green color scheme into windows, shutters and trim which makes a particularly attractive and pleasing effect.



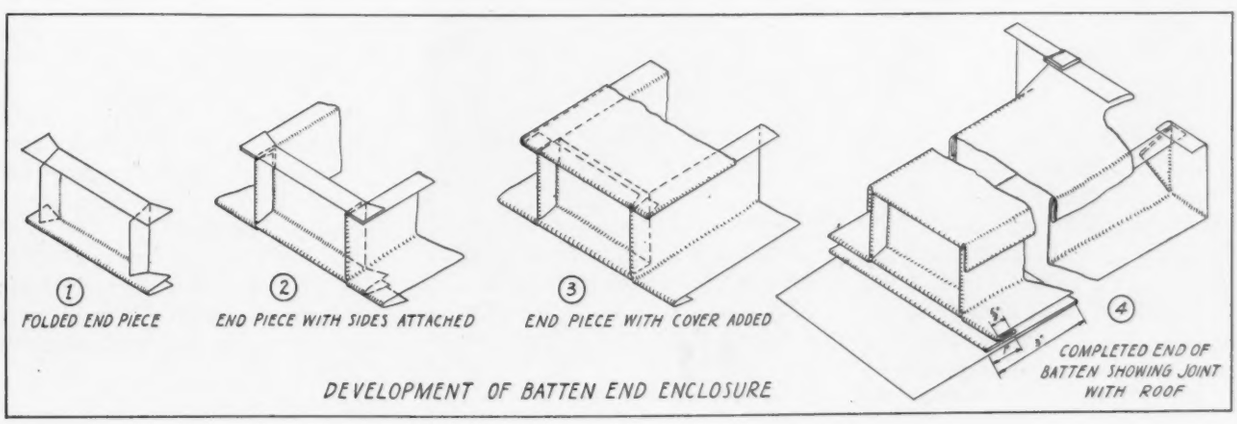
Construction of horizontal expansion joint at mid-point of slope.

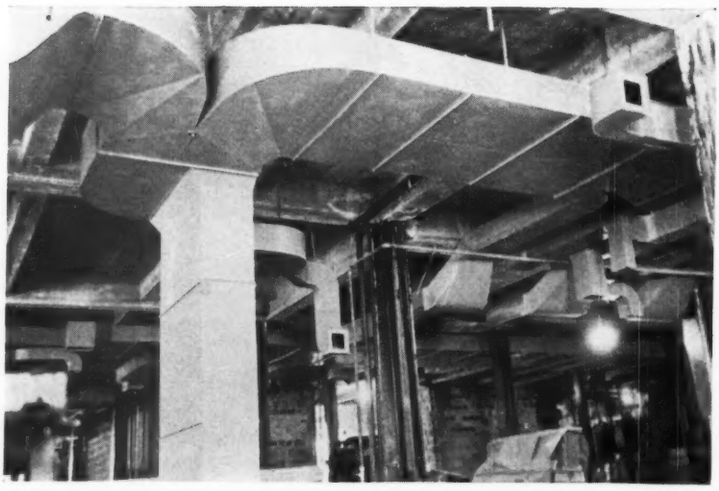
After the existing copper was removed, there was laid over the concrete roof slabs one ply of asphalt rag felt with 4-inch horizontal lap and 6-inch end lap. The felt was laid in the roof coating and brushed in immediately ahead of each sheet as laid. Surfaces to which coatings were applied were first thoroughly dried and swept clean. On top of the asphalt felt there was applied one layer of rosin-sized paper, lapped 2 inches at all edges. Cracks and pits found in the existing concrete slab were filled with plastic roofing cement.

Seams, Holes

All flat seams were fastened by cleats 1½ inches wide and about 3 inches long. The cleats were secured to the roof by 3/16-inch diameter, brass, flathead machine screws set in expansion anchors 1 inch long set about ¾ of an inch from the end of the sheet. The cleats ends were turned back

(*Continued on page 74*)





Design and Fabricating Details for a Ventilating System of the 1935 Type

ANOTHER member of New York's Civic Center Group of buildings, the Municipal Health Center is completed. This building has been designed to house the Departments of Health, Hospitals and Sanitation. The building, with its modern mechanical and laboratory equipment represents an outlay of $4,500,000.

The basement contains a clinical laboratory for treatment of city employees, storage rooms, record vaults and a large part of the mechanical equipment.

Two of the upper floors will be used for diagnosis, milk, chemical and Wassermann laboratories. The remaining floors are designed for office space.

The ventilating equipment includes two supply fans located in the basement which furnish air to the clinics in the basement and on the first floor; five main exhaust fans and one for refrigerating machine room exhaust, and eighteen fans for exhaust from fume hoods in laboratories.

The first floor clinic supply unit furnishes 18,500 cubic feet of conditioned air per minute; this system has adjustable intake louvres, four sections of Aerofin type pre-heaters, air washer, four sections of re-heaters and fan.

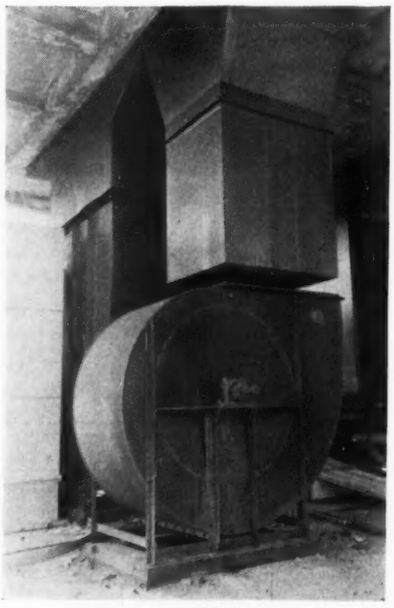
The second supply fan handles 12,000 c.f.m. of air, which is passed through dry type filters in place of an air washer, after which it is heated and distributed through galvanized ducts to the various clinic rooms located in the basement.

Each of these fresh air supply system includes an ionizing machine, as manufactured by Montgomery Brothers of Chicago and San Francisco. The purpose of these is to activate the oxygen in the air.

Above — View of duct work in first floor clinical rooms, showing typical construction.

Right — Exterior of the new Health Center Building.

Below — One of the exhaust fans in roof pent house. Note discharge fitting through roof slab.



A closed type water heater with copper tubes is used to heat the water supply to air washer. Humidity is controlled by a three-way diaphragm valve actuated by a thermostat located on discharge side of air washer.

Themostatic control is provided for louvred dampers placed across the face of the heating surface and bypass louvres under coils. Steam supply to heating surface is controlled by means of diaphragm steam valves. A two-point thermostat located in the discharge side of the fan controls both the dampers and valves.

Two self-contained heater and fan units supply air to the record vault. The air is exhausted from this area through ducts connected to the general exhaust system.

A 1,500 c.f.m. fan serves to exhaust air from the refrigerator machine room; the discharge duct from this fan is carried to outlets above the main roof level.

The main exhaust fans are located in penthouses above the main roof; there are two general exhaust systems, one clinic, and two toilet exhausts. These five units exhaust a total of approximately 155,000 c.f.m.

The discharge ducts from these fans are constructed of 32-ounce cold rolled copper, these extend to openings in the roof slab, immediately above which is a rectangular concrete outlet chamber provided with copper louvres on the four sides. Canvas sleeves complete the connection to the fan outlet in each case; these are also provided on the intake connection to each fan.

A pneumatic damper thermostatically controlled is installed in each discharge duct, to close when fan is not operating and thus prevent cold air from entering the building through the exhaust systems.

The fume hoods in the various laboratories are constructed of acid proof composition board, each has a ⅛-inch chemical lead connection 8 inches in diameter to an exhaust fan located directly above. Lead is also used to make the connection from the fan discharge to ceramic tile outlets through roof. All seams of the lead fittings are lead burned.

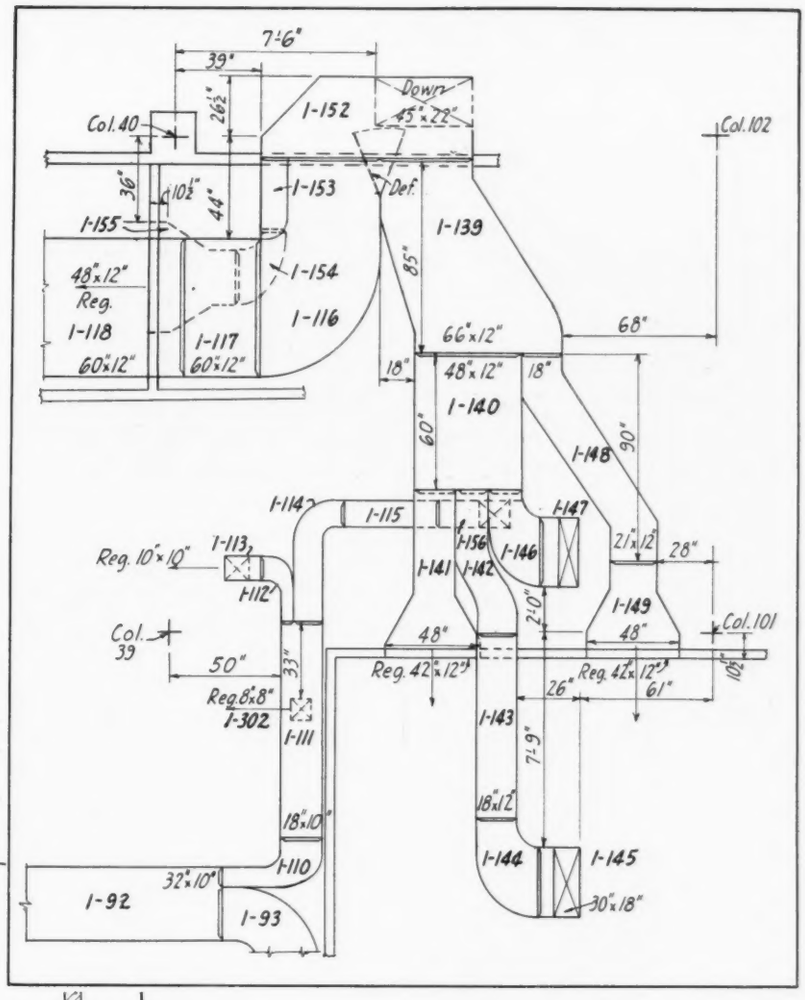
The wheels of these fans are constructed of monel metal, to resist acid fumes, and spare wheels are provided for replacements. Anti-vibration cork pads are provided under all fans throughout the building.

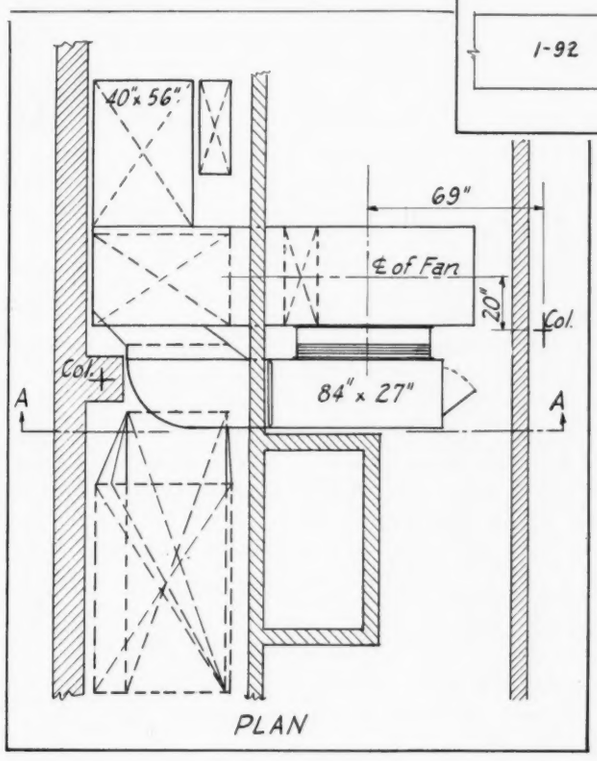
Fusible link fire dampers, with access doors through furred ceiling, are provided at each branch duct connecting to a vertical riser, to prevent spread of fire through the ducts from one floor to another.

All register flanges are backed with ⅛- by ¾-inch felt strips to prevent dirt streaking of walls. Guards of ½-inch expanded metal in angle frames enclose the belts.

We believe that it will be of interest to many of our readers to learn something of the procedure followed in handling an installation of this character . . . working drawings are made to a scale of ¾-inch = 1 foot. Steel construction plans are used to locate on the drawing, the columns, beams, and framed openings. Location of steam, plumb-

(*Continued on page 60*)

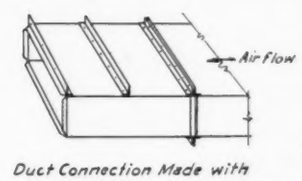




Above — Shop drawing showing method of numbering every metal section. Note guide measurements from structural steel. All metal is made up from drawings like this.

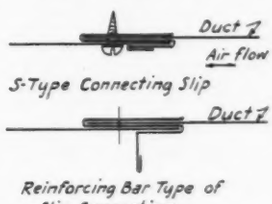
Left—Shop detail drawing for metal work around a supply fan.

Below — Typical details of duct construction used on this installation.



Duct Connection Made with Angle Irons on Long Dimension of Duct and slips on sides.

Type of Lock Seam on Corners of Fittings



Reinforcing Bar Type of Slip Connection

The Warm Air-Fan System of Heating and Ventilating for Large Buildings

By Platte Overton
Consulting Engineer

The fan-furnace heating and ventilating field for larger structures has become surprisingly active during the last year. From all appearances this form of heating seems likely to enjoy a popularity which will mean profits for the contractor able to design and install such systems. To supply such information we begin here a series of articles which will design step-by-step a complete system for a school, theatre, church, factory, public hall.

Introduction

FOR a number of reasons, the use of the warm air-fan type of heating and ventilating system for large buildings has not enjoyed the popularity that its many advantages warrant. It is certain that this lack of recognition is largely due to the failure, on the part of manufacturers, to provide the architect, engineer and sheet metal contractor with the proof of the worth, together with data for the design and installation of the systems.

Much has been said and written about direct fired-fan systems that has been either the result of erroneous conceptions of the principles involved or a studied attempt to discredit a system that has unquestioned advantages. In spite of all that has been said and written about this system, it still remains a very practical method, under many circumstances, both because of exceptional economies in installation and operation and because it is an indirect system, hence applicable to air conditioning in any one or all of its branches.

Characteristics

Essentially the warm air-fan system of heating and ventilating consists of large direct fired heaters or furnaces over which the volume of air to be heated is forced by a motor driven fan. There are no complicated parts or delicate control adjustments. There is nothing to rust, crack, burst or explode. There is no water line to become abnormally low and endanger the heating system or to become abnormally high and reduce its efficiency to a minimum. During much of the heating season, these direct fired heaters will warm the air with a fire that would be insufficient to generate steam.

Direct fired heaters are extremely flexible. They are suitable for combustion rates of 4 to 20 pounds of coal per hour per square foot of grate surface. In most latitudes, zero weather occurs only a few times per year, hence the high combustion rate is seldom necessary.

Direct fired heaters are suitable for any type of fuel. The firebox is large enough for efficient stoker application, or they may be fired with oil burners using an ordinary domestic type of burner. They may be adapted for gas with a few minor changes.

These direct fired heaters permit the use of any standard type of air washer or filter for either outside air or recirculated delivery.

Cost

The warm air system of fan heating and ventilating can be installed for 20% less than the cost of a "split steam" system, and 50% less than a straight "hot blast" steam system, with the same ventilating qualities. The maintenance cost is particularly low. Grates may need replacement occasionally, but there are no traps, valves, boiler feed pumps or control equipment that need replacement.

In general, the design of a warm air-fan system of heating and ventilating follows the same method employed in the design of a hot blast system of steam, except direct fired heaters (furnaces) are substituted for the vents, pipe coils or aerofin. Many books have been written on the subject of the design of such systems, and it will be considered unnecessary to take up readers' time with any lengthy discussion or treatise. The following articles will be confined largely to the general design of such systems, their installation, costs, and various arrangements to meet different conditions.

The Articles

Five types of buildings will be discussed in our articles. They are, in order: factories, schools, churches, theatres and public halls. All the buildings included are actual installations, with possible alternate designs shown.

It is not the purpose of these articles or this chapter to recommend the warm air-fan system for any or all buildings of all sizes

and types. The reader should realize that there are limits to the practical application. Such systems have been installed in buildings a block square and containing more than 100 rooms, but such systems are exceptional and do not interest us in these practical discussions.

These articles will deal with the average small town grade or high school, theatre, factory, or church. Such buildings offer a good opportunity to the local ventilation contractor who is in position to furnish and install warm air fan heating and ventilating.

Ventilation

Where the local or state ventilation code demands ventilation, such must be provided, regardless of the type of heating. Where split steam systems are specified, the warm air-fan system may be installed and the ventilation ducts used for heating.

Why System Is Ideal

The warm air-fan system is the answer to the following problems that face most architects or school boards who contemplate a new school or the remodeling of an old one: (1) Lack of sufficient money—the warm air-fan system is cheaper. (2) The water problem—many communities have a water supply that is not fit for a boiler. (3) The building engineer—the warm air-fan system does not require a licensed engineer to operate the plant. (4) Ventilation laws—some states require that all outside air be used, and no recirculation is permitted. The warm air-fan blast system is suitable for high combustion rates on extremely cold days, and can heat large volumes of air through a wide temperature range—as high as 150°. The steam system that can do the same work on these exceptionally cold days, is prohibitive in price. (5) Maintenance—the maintenance of the warm air plant is exceptionally low. (6) Assurance of proper ventilation—the warm air-fan system must have the fan running or no heat is available. Many well-installed split steam systems provide heat with the direct radiation in the rooms, and the engineer who is trying to save coal, or hates to shovel it, fails to turn on the fan. (7) Power consumption—the average warm air-fan system will require less power than that required for the split steam system or steam blast installation. These seven points are sufficient to get the contractor consideration if the architect or school board is forced to consider any three of them seriously.

It is well to state at this time that the term "forced air heating" will not be used hereafter in this book. The term "furnaces" will be avoided. Such furnaces will be referred to as direct-fired heaters and we advise the reader to use this term while selling, as members of church communities, school boards and theatre or factory owners are prone to visualize "furnaces" as the round pot heater in his own basement that may or may not be a recommenda-

(*Continued on page 70*)

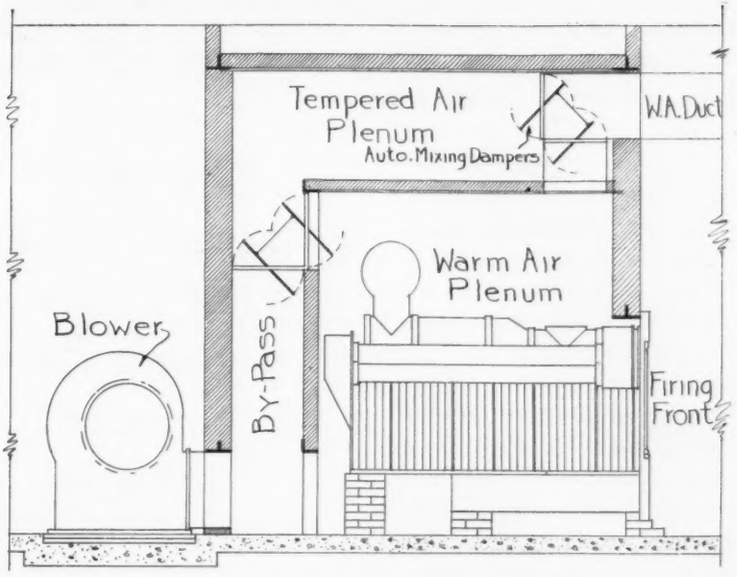


Fig. 2.—An overshot system showing the warm air plenum, tempered air plenum and mixing dampers.

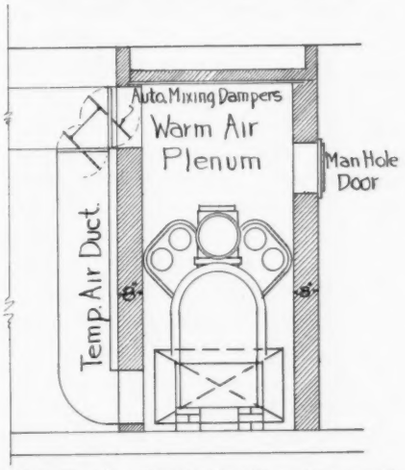


Fig. 3.—An "undershot" system used where there is lack of headroom. Note location of tempered air plenum up the side.

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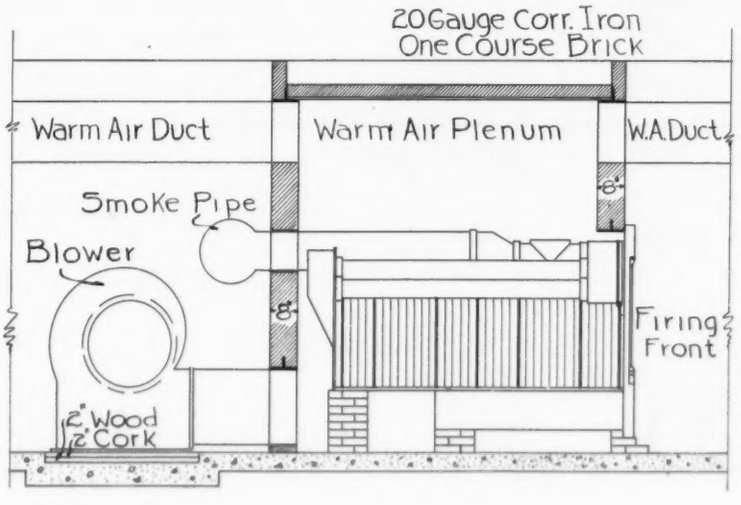
Fig. 1—Below shows a common type of system without a tempered air plenum chamber. The air heated by the direct fired heater is blown into the ducts by the fan.

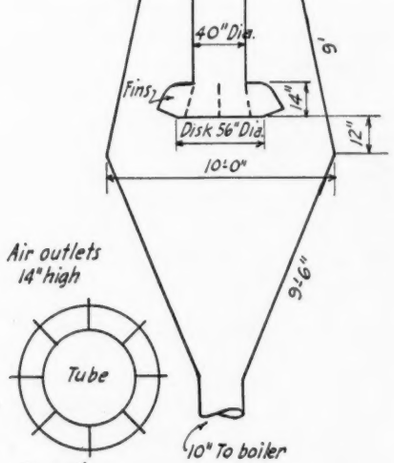


I have installed a dust collecting system in a plant in this city for collecting dust from sanding machines. The dust is from thoroughly dried bass wood. There are three machines with an intake capacity of about 300 sq. in. of air and I am using a 60-inch slow speed Arlington-Curtiss Blower running 470 R.P.M. The discharge pipe is 23 inches in diameter, connected to an Arlington-Curtiss Dust collector built for the 60-inch fan. The intake end of the piping takes the dust away from the machines perfectly, but our trouble is in the collector. Approximately 75% of the dust seems to pass through the collector.

The enclosed sketch is the exact dimensions of the collector. We would like to know if there is some way of changing the design of this collector to deposit the dust through the bottom of the collector in place of air tube and elbow.—A Reader.

Construction and Operating Changes When Dust Passes Through The Collector

By J. W. Baybutt
Instructor, Rochester Athenaeum and Mechanics Institute



THE following sketch is suggested as the layout of the exhaust system mentioned.

It would appear from the layout and information submitted, that the fan is handling about 10,000 C.F.M. Assuming the dust to be very fine, which would be a natural assumption to make when obtained from such a source, it is very possible that the finer dust will be carried through the vent of this type of separator when handling this amount of air.

If it is definitely determined that 75 per cent of all the dust is exhausting to the atmosphere it may be well to check the dust discharge piping into the boiler. A throttled dust outlet will cause excessive dust escape and in a case like this (where the dust is to be used as a fuel) it is very likely that the operating engineer has definite ideas on how much air he needs above the fire. If he dampers this outlet back then he reduces the dust carrying capacity of the 10-inch outlet which in turn changes the operating characteristics of the separator. Any other form of obstruction would necessarily cause the same condition.

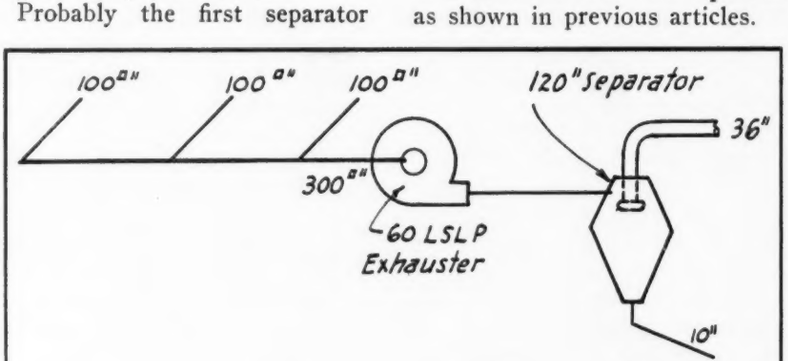
After checking the dust outlet end of the separator the next move I would make would be to cut back the suction at the sander hoods to a minimum, either through dampers or otherwise.

A change in hood design sometimes proves very efficient even though the amount of air is considerably reduced. The smaller the amount of air handled with this type of separator and dust, the more efficient dust separation will prevail generally. If dampering the nozzles materially changes the dust separation without destroying the collecting at the sanders, then the fan speed could be reduced to decrease the power required. Numerous changes could be tried in the separator, but not much improvement is hoped for by this action.

Probably the first separator change we would experiment with, would be the removal of the disk and fins. A smaller disk could be installed say 20 inches below the outlet; the idea being to cut down the air velocity at this point.

The writer's experiences with separation of the finer dusts has convinced him that the centrifugal type separator is not to be counted on for 100 per cent separation if such can ever be obtained in any way. The writer has had fairly good success with a patented centrifugal separator of seemingly radical design on one fine, heavy dust, but we generally end up with paper, cloth or similar methods if the dust is valuable or obnoxious to the surroundings.

In this case a cloth separator installation could be easily made in connection with the separator as shown in previous articles.



The Minneapolis Heating, Ventilating and Air Conditioning Ordinance

The first Minneapolis code was formulated in 1926. This revised code, made effective this spring, was written chiefly by the Building Inspection Department from its experience. Until this year the Minneapolis code has been eminently satisfactory—as proof—heating firms decreased from 133 to 40 between 1926 and 1935. This year lack of funds has necessitated economies admitting some violations but more building is raising revenue. More of the code will be published next month. We will gladly answer questions.

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AN ORDINANCE

RELATING to and Regulating the Construction, Installation, Alteration, Maintenance and Repair of Heating, Ventilating and Air Conditioning Plants and Equipment in or for Buildings of All Classes within the City of Minneapolis.

The City Council of the City of Minneapolis do ordain as follows:

PART I
GENERAL PROVISIONS

Section 101. The provisions of this ordinance shall govern the construction, installation, alteration, maintenance and repair hereafter, within the City of Minneapolis, of all heating and air conditioning plants and equipment in or for all buildings within the City of Minneapolis.

Section 102. Permit and Approval of Plans Required, When: It shall hereafter be unlawful for any person, firm or corporation to construct or install any heating or air conditioning plant or equipment, such as is subject to regulation by the provisions of this ordinance, in or for any building or to alter or repair any such existing heating or air conditioning plant or equipment, without first making written application to and securing a permit from the Inspector of Buildings therefor, or to fail or neglect to comply with the provisions of this ordinance and of the permit so issued thereunder, and any person, firm or corporation, when applying for any such permit shall, upon demand of said inspector, furnish him with all necessary plans, in duplicate, for such proposed construction, installation, alteration or repair and with all proper and sufficient information relating thereto and shall secure his approval of said plans before such permit shall be issued. Provided, however, that the Department of Buildings may waive the above requirement of a permit in the case of alterations or repairs to any existing heating or air conditioning plant or equipment where the cost of such alterations or repairs will not exceed Twenty-five Dollars ($25.00), if such alterations or repairs will not add to the required capacity of such heating or air conditioning plant or equipment and are not, in the opinion of the Department of Buildings, of such a nature as to render an inspection of same desirable.

Section 103. Permits to be Issued Only to Licensed Installers: No permit for the construction, installation, alteration or repair of any heating or air conditioning plant or equipment shall be issued by the Inspector of Buildings to any person, firm or corporation, except he or they be duly licensed by the City Council, as required by ordinance, to do such work.

Section 104. Licenses to be Revoked for Unlawful Securing of Permits for Others: Any person, firm or corporation duly licensed, as required by ordinance, to construct, install, alter, maintain or repair any heating or air conditioning plant or equipment who shall, as such licensee, take out or secure a permit such as required by this ordinance for work to be done by any person or persons not connected with such firm or corporation, nor in the employ of such licensed person, firm or corporation, or who shall allow his or their name to be used by any other person or persons for the purpose either of doing any such work or obtaining permit therefor, shall by such act, upon conviction thereof, forthwith forfeit his or their license, and the Inspector of Buildings shall thereafter refuse to issue any further permits to construct, install, alter or repair any heating or air conditioning plant or equipment under any license so forfeited.

Section 105. Test Data, Measurements, Ratings, Capacities, etc., to be Recorded: Before a permit shall be issued by the Inspector of Buildings, as herein provided for, for the installation of any warm air furnace, or of any device performing some specific service in connection with any heating or air conditioning system or plant, the capacity of which device might affect, in whole or in part, the efficiency of the system or plant, the contractor installing such furnace or device, or the manufacturer of same, shall furnish said inspector with such test data, measurements, ratings, capacities or other information as may be required by said inspector for the purpose of determining ratings or capacities of such furnaces or devices in accordance with the provisions of this ordinance.

105.1. Affidavits Required: All such test data, measurements, ratings or capacities so submitted to the Inspector of Buildings as above provided for, shall be accompanied by proper affidavits as to the correctness of the same, each such affidavit to be made by the manufacturer of the furnace or device for which the test data, measurements, ratings or capacities referred to therein were submitted.

105.2. Ratings or Capacities Determined by Department, When: Provided, however, that the Department of Buildings shall determine the rating or capacity for any second hand furnace or device which is no longer manufactured, which is to be used in connection with any heating or air conditioning system or plant and for which the above required test data, measurements, ratings or capacities are not available in the manner set forth in those certain sub-sections of Parts XI and XII of this ordinance providing for such ratings or capacities.

Section 106. Department to Have Supervision; Tests, Inspections, etc.: All construction, installation, alteration and repair, hereafter, within the City of Minneapolis, of heating and air conditioning plants and equipment, subject to regulation by the provisions of this ordinance, in or for buildings of all classes, shall be done under the supervision and subject to the approval of the Department of Buildings.

It shall be the duty of the Inspector of Buildings and his regularly authorized assistants assigned to such work to enforce and cause to be enforced the provisions of this ordinance and to supervise all necessary tests and make all necessary inspections of heating and air conditioning plants and equipment installed thereunder, and said inspector and assistants are hereby given full authority to pass upon and either approve or disapprove any material or device, not specifically provided for in this ordinance, proposed to be used in any heating or air conditioning installation for which a permit is required, to require such tests to be made as may be necessary to determine the tightness of any sheet metal ducts or pipes, and to require the immediate removal of any material or construction found to have been so installed as to conceal or cover up, before its inspection and approval by the Department of Buildings, any newly installed portion of any heating or air conditioning system or plant.

Section 107. Inspections and Tests, Notice to be given by Contractor. When: Unlawful to Cover up Work Before Inspection: The heating or air conditioning contractor shall immediately notify the Department of Buildings, upon the completion of the installation, that the work for which a permit had been issued, as required by this ordinance, is ready for inspection and test, in the case of an air conditioning installation, or for inspection, in the case of a warm air installation, by registering the number of the permit and the location of the work in the inspection order register book kept for that purpose in the office of the Inspector of Buildings.

In any new building and in any new addition to an older building, in those portions of the installation which are thereafter to be concealed or cov-

ered up, in any heating or air conditioning installation for which a permit has been issued as required by this ordinance, the heating or air conditioning contractor shall notify the Department of Buildings, in the manner above provided for, that said portions of the installation are ready for inspection and test, if it be an air conditioning installation, or for inspection, if warm air. Said contractor shall also, at said time, post in a conspicuous position on such portion of the installation a notice, which notice shall be in substantially the following form: "Warning. This piping has not been inspected and approved by the Department of Buildings and must not be covered up or concealed until so inspected and approved." No person other than the inspector from said department shall thereafter remove said notice, nor shall said inspector until he shall have attached to said piping a notice stating that the same has been inspected and approved. Any unauthorized person who shall remove any such notice or cause the same to be so removed, and any person having charge of the construction of such new building or addition, or any other person, who covers or conceals, or causes to be so covered or concealed, any of such portions of such heating installation before the same shall have been approved by the Department of Buildings, shall be subject, upon conviction thereof, to the penalty herein provided for any violation of this ordinance.

107.1. Tests of Air Conditioning and Warm Air Furnace Fan Installations: After notifying the Department of Buildings, as hereinbefore provided, that any newly installed air conditioning or warm air furnace fan system, or portion thereof, is ready for inspection and test, the contractor installing same shall, in each such case, make such test, in the presence of and under the supervision of the inspector from said department, as may be necessary to demonstrate the delivery of the required amounts of air to the various parts of such system. No such system shall be approved by said department until found, under such tests, to be fulfilling all requirements of this ordinance pertaining to such system.

Section 108. Minimum Requirements: The provisions of this ordinance shall be held to be minimum requirements adopted for the protection of the health, welfare and safety of the community.

Section 109. Replacements: Any warm air furnace, fan, blower, air conditioning equipment or any appurtenance connected with any of the above, installed to replace any existing equipment of like nature in any existing plant or system shall be of such capacity as would be required under this ordinance were such furnace, fan, blower, air conditioning equipment or appurtenance to be installed for use in connection with a new plant or system designed, as would be required by this ordinance, to meet the heating or air conditioning requirements for said building.

Provided, however, that in buildings other than single and two (2) family dwellings where, in the opinion of the Inspector of Buildings, it would be impracticable or would work an unnecessary hardship to require a complete compliance with the foregoing requirements, a warm air furnace, fan, blower, air conditioning equipment or appurtenance, based as to capacity on the connected load, may be installed to replace any existing equipment of like nature.

Section 110. ALTERATIONS, ADDITIONS AND REPAIRS.

110.1. Alterations: Any alterations hereafter made to an existing heating or air conditioning system or plant, in or for any building, shall be made in conformity with the requirements of this ordinance in so far as may be practicable, in the judgment of the Department of Buildings, without impairing the efficient operation of the system as a whole, or of any portion thereof.

110.2. Additions: Wherever the heating or air conditioning requirements, as determined by this ordinance, of any existing building provided with a heating or air conditioning system or plant are hereafter increased, either by the construction of an addition or additions to said building or by an increase in the portion of said building to be heated or air conditioned, or in any other manner, the capacity of the heating or air conditioning system or plant serving same shall be increased to that capacity which would be required by this ordinance for a new installation designed to meet equal heating or air conditioning requirements.

110.3. Repairs: Repairs to any heating or air conditioning equipment shall be made in such manner as to restore such equipment, as near as is practicable, to its original sound condition. Such repaired equipment shall be subjected to such tests as may be required, in the opinion of the Inspector of Buildings, to satisfactorily demonstrate its ability to meet the service requirements to which it may normally be subjected.

PART II
MINIMUM REQUIREMENTS FOR ESTIMATING HEAT REQUIRED FOR WARMING BUILDINGS

Section 201. The method which shall be used in computing the minimum amount of heat in British thermal units (B.T.U.) per hour which must be supplied to or generated within any building to maintain the inside temperature hereinafter stipulated, with the outside temperature and wind movement assumed as in this ordinance provided, shall be as hereinafter set forth in Part II of this ordinance, and shall apply to all types of heating systems. The inside temperature shall be measured at the breathing line, which shall be on a plane two feet six inches (2' 6") above the floor level and not less than three (3) feet from any outer exposed wall. The procedure which shall be followed in using the data in Part II of this ordinance for estimating the heat required for warming buildings shall be as follows:

(A) Select from Table No. 1 the inside air temperatures, at the breathing line, which are to be maintained in the building during the coldest weather.

(B) The outside air temperature which shall be used for design purposes shall be taken as twenty (20) degrees Fahrenheit below zero.

(C) Select from the following tables or secure from the Department of Buildings the heat transmission coefficients for outside wall and glass, also for any floor, wall or ceiling next to unheated space and any portion of roof next to heated space.

(D) Measure up net outside wall, glass and roof next to heated spaces, as well as any cold floor, wall or ceiling next to unheated space. Such measurements shall be made from the building plans submitted to the Department of Buildings by the heating contractor. Should it subsequently develop that said plans so submitted are inaccurate in any essential detail, it shall be the duty of the heating contractor, upon being notified so to do by the Inspector of Buildings, to make such changes in the heating installation as may be necessary to correct any resulting discrepancy therein and to bring same into conformity with the requirements of this ordinance.

(E) Compute the heat transmission losses for each kind of wall, glass floor, ceiling and roof in the building by multiplying the heat transmission coefficient in each case by the area of the surface in square feet and then by the temperature difference between the inside and outside air. (See items A and B.) (See also tables in Section 203 for Heat Transmission Coefficients.)

(F) Select unit values and compute the heat equivalent of the infiltration of cold air taking place around outside doors and windows. Said unit values shall be taken to depend on kind and width of crack as assumed in Table No. 9 of this ordinance, with wind velocity assumed at fifteen (15) miles per hour, and when multiplied by the length of crack, and then by the temperature difference between the inside and outside air, the result shall be taken to be the heat required to warm the cold air leaking into the building per hour.

(G) The sum of the heat losses by transmission (Item E) through the outside wall and glass, as well as through any cold floors, ceilings or roof, and the heat equivalent (Item F) of the cold air entering by infiltration or introduced mechanically shall be taken as the total heat required for maintaining the required inside temperature in the building.

Section 202. Inside Air Temperatures: The minimum inside air temperature which shall, for the purposes of this ordinance, be assumed as that to be maintained within a building shall be as given in the following table:

TABLE NO. 1
ASSUMED INSIDE AIR TEMPERATURES

Type of Occupancy			Degrees Fahrenheit
Dwellings as defined by the State Housing Act, Offices, Retail Stores, Schools, Places of Assembly, Theatres, Dance Halls, Restaurants or buildings of similar occupancy and all employment areas of more or less sedentary occupations			70
Industrial spaces	Employment areas	Slight labor	65
		Heavy labor	55
	Storage areas		None
Garages	Storage		40
	Employment areas		60

Provided, however, that in industrial and storage spaces where the manufacture, processing or storage of materials or products requires a temperature lower than those above specified,

(*Continued on page 77*)

Air Conditioning Section

Devoted to the technical and merchandising problems of air conditioning in homes and small buildings

BEGINNING with this issue the Air Conditioning section departs somewhat from previous practice. We will publish during the winter articles dealing with such phases of air conditioning as humidifying, cleaning, effective temperature, insulation, condensation, vitalizing the air, etc.

. . . The reason is because we feel that the industry has given most of its attention to mechanical air circulation and not enough thought to those factors which are equally as important to users' comfort.

. . . It is high time, too, that we begin to understand and use as sales weapons these other comfort factors. Too many competitors can talk about forced air, but few can yet talk intelligently and show examples of successful application of these truly air conditioning comfort factors.

The Electric Janitor Package shown with Heat Leveling Thermostat. Also available with Heat Leveling Clock Thermostat which automatically lowers and restores temperature at any predetermined hour to conserve fuel . . . .

The Electric Janitor

A Low Priced Damper Regulator Package with the Heat Leveling Thermostat

■

THE Electric Janitor Damper Regulator Package gives you the unequalled performance of "leveled heat" – and gives it to you at a new low price. Operating on the proved principle of heat actuation, the sensational Electric Janitor heat leveling thermostat is equipped with a small electrical heater and metal "sponge", which provides a minimum "on" period of from 6 to 14 minutes, depending upon adjustment. This insures the constant generation and delivery of sufficient heat to cause circulation and avoid stratification, but not enough to cause overheating. The Electric Janitor Package is the last word in damper control. For complete information, write Minneapolis-Honeywell Regulator Company, 2726 Fourth Avenue South, Minneapolis, Minnesota.

Branch and distributing offices in all principal cities . . . In Canada: Minneapolis-Honeywell Regulator Co., Ltd. 117 Peter Street, Toronto. European sales and service: 233 Heerengracht, Amsterdam, Holland.

■

Safeguard with
LIMIT CONTROLS

■

Minneapolis-Honeywell limit controls will safeguard and improve performance on any heating system. They can be used in conjunction with the Electric Janitor. This complete line of limit controls, like the Electric Janitor Package, is exceptionally low priced . . . .

MINNEAPOLIS-HONEYWELL

Control Systems

BROWN INSTRUMENTS FOR INDICATING, RECORDING AND CONTROLLING

WE ARE HEADQUARTERS FOR WINTER AIR CONDITIONING

GOLDEN STAR FURNACE

EMERSON BLOWER

No matter what item of equipment you might need to install a good winter air conditioning job, you can secure it from us. No matter how small or how large, if it goes into a winter air conditioning installation, you may rest assured it is the best of its type. This we insist upon in order to meet our guarantee of dependability in products and service. The many years that we have been in business have taught us to supply only the best to our customers, and that in turn makes satisfied customers for them.

A DEPENDABLE SOURCE OF SUPPLY . . .

Following are some of the many items of winter air conditioning equipment we carry:

Furnaces—Blowers and Fans—Air Filters—Air Conditioner Boosters—Controls and Accessories—Registers, Grilles and Faces—Damper Regulators—Air Washers—Furnace Pipe and Fittings—Automatic Humidifiers.

All orders given prompt attention from one of our three conveniently located warehouses.

THE J. M. & L. A.
OSBORN Co
MANUFACTURERS - DISTRIBUTORS
DETROIT - CLEVELAND - BUFFALO

HANDY

PIPE IS WORTHY OF YOUR BEST JOBS—

And Economical Enough to Use on Your Competitive Jobs!

•

With it, you can meet every furnace-fitting requirement . . . at lowest cost . . . with a QUALITY product . . . with labor-saving advantages . . . and the assurance of complete customer-satisfaction through the years.

•

F. MEYER & BRO. CO.
Peoria Illinois

OUR FREE ESTIMATING SERVICE IS MAINTAINED TO HELP YOU—

USE IT!

HANDY

DUCT WORK FOR FORCED-AIR INSTALLATIONS

not only enables you to install the jobs according to the most advanced ideas in forced-air and air-conditioning practice; but it also eliminates all guesswork, keeps labor cost down . . . and gives a finished appearance that meets today's requirements.

•

F. MEYER & BRO. CO.
Peoria Illinois

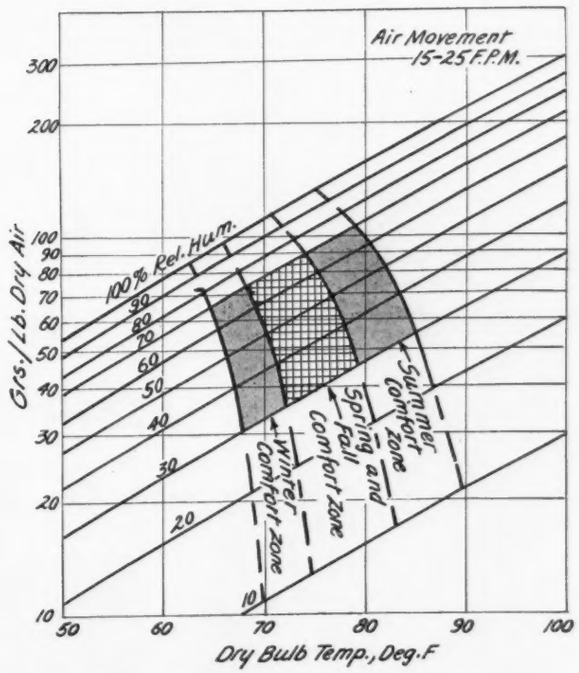
Temperature and Humidity— Inseparable Factors of Air Conditioning

By Guy S. Faber

In a preceding article (Dec., 1934) the author outlined the effect desired in interior conditions. This article explains how temperature and humidity are tied together. Some related factors are also presented.

WE express temperatures in degrees Fahrenheit and humidity in relative percentages. Now let us find out why this is done so we can understand the basic principles involved and be able to read and use a Hygrometer in our own home and know just what it actually means to our health, furnishings and coal pile or other fuel bills.

Let us take one cubic foot of air at zero degrees F. and deal with both the temperature and humidity of this one cubic foot of air. First we will state that water or moisture passes into air by evaporation and out of it by condensation. With this in mind, the cubic foot of air at zero degrees F., when fully saturated with moisture, or as much as it can possibly hold, in invisible suspension is one-half grain of water. This we call 100 per cent relative humidity. The term relative humidity is an expression in percentage of the degree of saturation of air at any given temperature. Air is like a sponge. By heating air, we open up this sponge to sustain greater quantities of water. Cooling the air is like squeezing water out of a sponge. (Figs. 1 and 2.)



The zone of comfort is different in summer and winter. This chart shows how the zone shifts upward during the summer and also shows a middle zone suitable for all four seasons of the year. These zones are for an air movement ordinarily found in a gravity or intermittent forced air system. Relative humidity is plotted against dry bulb temperature.

Now, if our cubic foot of air contained but one-fourth grain of moisture at zero instead of one-half grain, it would then have a relative humidity of 50 per cent. We will raise the temperature of our cubic foot of air to 70 degrees F. At this temperature our cubic foot of air can hold 8 grains of moisture in invisible suspension or sixteen times as much moisture as it did at zero. By heating the air

(*Continued on page* 48)

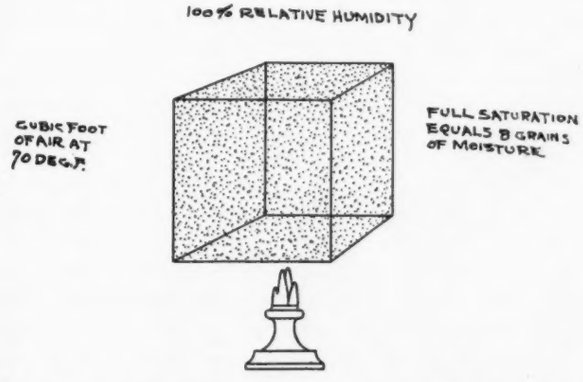


Fig. 1—This pictures a cubic foot of air at 70 degrees, 100 per cent saturated with moisture. The air does not "hold" the moisture; the moisture is self supporting.

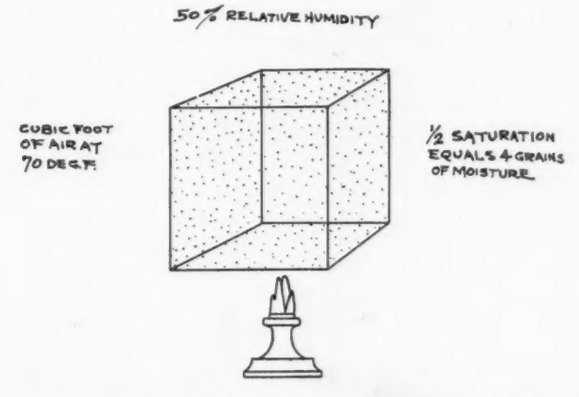
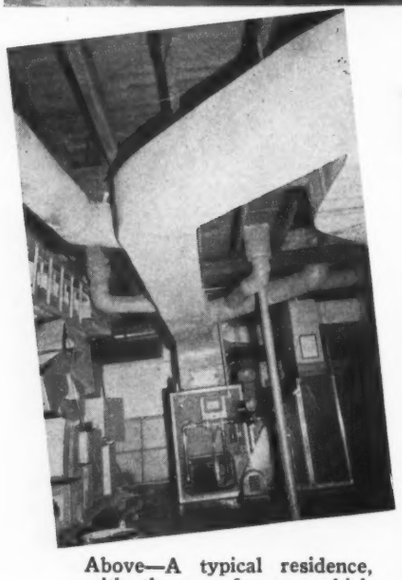
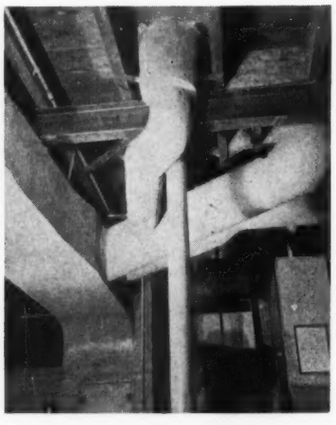


Fig. 2—If the cubic foot of air contains only half the amount of moisture it CAN hold we have 4 grains of moisture and "50% relative humidity."

Cost Saving Practices of the Trask Heating Co., Boston



Above—A typical residence, with the gas furnace which replaced a gravity system and, right, closeup of round pipe branches off a rectangular main.



Above—Another installation in a new house showing the long rectangular main with round pipe branches and method of insulating plenum and all pipes.

IN Boston, Massachusetts, the Trask Heating Company (established in 1885) has developed a method of cooperation with direct selling manufacturers which permits them to do much of the engineering and assume practically complete responsibility for the installation, but leaves to the manufacturer the selling of the job and the right to check all work in the blue print stage and during and after completion.

Mostly Remodeling

In the last two years there has been a considerable amount of gas home heating installed throughout the Boston suburban area. The gas furnished is a manufactured product of approximately 550 B.t.u. requiring careful design to prevent excessive heating costs. Several of the large manufacturers have made noticeable headway in selling forced air, gas fired equipment providing humidification, cleaning, positive circulation, and the convenience of gas.

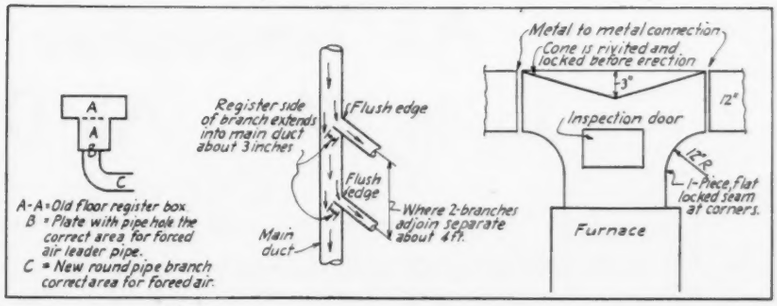
Further, while there has been some new construction in the Boston area, a large majority of the systems installed have been placed in old houses, replacing steam, hot water, vapor and gravity warm air. As a result the problems of installation are particularly acute, especially in those older houses where practically every opportunity to install cheaply is prevented by the construction of the house. In two-story houses, with old gravity warm air systems, existing stacks and registers must be used unless major structural alterations are undertaken.

To meet these conditions the Trask company has developed a number of interesting practices shown by the photographs, drawings.

Basement Piping

Whether the original system be gravity warm air or some form of boiler heat, the Trask company recommends wholly new basement piping. Several years of attempting to use gravity pipes for forced air has convinced Trask engineers that the trouble encountered is not worth the saving in material. Further, trying to use old gravity pipes involves uncertain air flow results throughout the system and prevents the use of the low cost, rectangular–round pipe branch system which has been developed.

In general, this combination piping practice consists of running out from the bonnet a rectangular main duct as far as the beginning of the last branch or last cluster of branches. In some instances (such as one of the houses shown in the photographs) this rectangular main may run practically the full length of the basement. In other cases there may be two or more short, rectangular mains. But because the company recommends placing the furnace in an out-of-the-way corner or end, thus conserving usable


A
A
B
C
A-A=Old floor register box.
B = Plate with pipe hole the correct area for forced air leader pipe.
C = New round pipe branch correct area for foreed air.
Register side of branch extends into main duct about 3 inches
Flush edge
Flush edge
Where 2-branches adjoin separate about 4 ft.
Main duct
Metal to metal connection. Cone is rivited and locked before erection
3"
12"
Inspection door
12" R
1-Piece, flat locked seam at corners.
Furnace

Details of the construction of the five-piece plenum chamber with metal to metal connections to ducts. Also a detail of a round pipe cut into a main and showing the "air scoop." At left a detail of the properly sized forced air plate which fits into the bottom of old register boxes, eliminating cutting and new box.

basement area, the usual installation consists of one long main and perhaps one or two short stub mains.

The two installations pictured show gas fired furnaces with an overall height which permits carrying up a rather high plenum chamber from which the mains are tapped out horizontally as close up to the joists as plumbing permits. As shown in a detail, the branches are round pipes tapped into the sides of the main in such a way that the branch starts at an angle with the main thus eliminating a right angle air turn from main into branch. The furnace side edge of the branch pipe is tapped in flush to eliminate any obstruction to air flow over the edge. The farther side of the round pipe is so cut that the edge extends into the main about 3 inches, thus providing a cup to catch the air and guide it into the branch.

Placing and Sizing Branches and Mains

The practice is to separate branches about 4 feet whenever possible to avoid pockets of turbulence and when this is not possible the pipes are staggered—one toward the top and the next toward the bottom—of the rectangular side.

In many of these installations the rectangular main is sized for the amount of air required by all branches off the main and the rectangular pipe is continued in practically equal area from furnace to the end. The result is the main serves as an extended plenum kept under pressure. In cases where most of the branches are taken off close to the furnace with one or two from the remote end, the main is reduced in cross section area beyond the first group of branch pipes. In other installations where branches come off at regular intervals the rectangular main is reduced in area from branch to branch.

Each round pipe branch carries a volume damper and quadrant placed some little distance out from the main. Forty-five degree elbows are used in preference to 90-degree sections. In replacement work where register boxes are already in place and especially for floor registers which are common around Boston, the round pipe is tapped into the bottom of the old box without making a new fitting. A special plate is cut for the bottom of the box having a circular hole of the diameter of the required round pipe branch. This plate replaces the bottom of the box and supplies to the register the correct amount of air required.

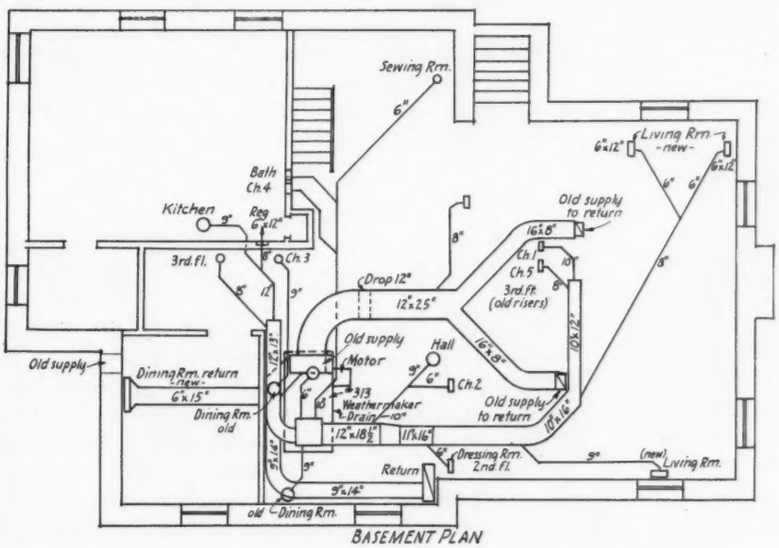
Mains are sized for velocities around 800 feet per minute; branches for about 500 F. P. M. and floor registers operate at about 250 F. P. M.

To conserve all possible heat and to prevent so far as possible temperature drop in the air passing through the ducts the practice is followed of covering both rectangular mains and round pipe branches with ½-inch of air cell painted on the outside. Openings are made in the insulation where the quadrants come through as shown. The plenum chambers are likewise covered.

Plenums

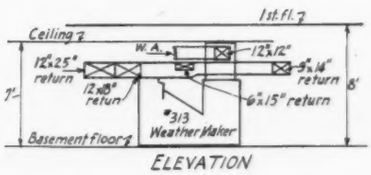
In connection with the plenum a special section has been developed as shown in a detail. Two sides

(*Continued on page* 52)



BASEMENT PLAN

Basement piping plan of a typical remodeled job showing extent of rectangular mains and use of round pipe branches. Note mains are carried out only so far as their use is economical.



ELEVATION

Air Temperature Drop in Warm Air Ducts

By N. C. Ebaugh
Head, Dept. of Mechanical Engineering, University of Florida

Readers will remember the article on temperature drop in ducts published in our November, 1934 issue. The author of this article approaches the subject from the mathematical angle and proves that duct losses should be considered. We invite you to compare the results obtained by the two methods.

IN ORDER to accurately calculate the proper amount of air to be supplied to each room of a forced warm air heating installation, it is necessary to know the register air temperature. This temperature is equal to the temperature leaving the furnace or heating coil minus the temperature drop which occurs in the duct system.

Often it is necessary to run ducts through unheated areas beneath the floor or in the attic in order to reach the wall stacks. This discussion presents a method which will permit the rapid estimation of the temperature drop in such ducts.

Present Procedure

The 1935 GUIDE of the A. S. H. & V. E. states the need of estimating this temperature drop in the chapter on Fan Systems of Heating and recommends the following: "For ducts in outside walls or attics, or other exposed places, allow 0.25 degrees F. per linear foot of uninsulated duct."

It appears that this allowance may be satisfactory

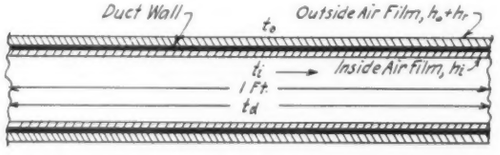


Fig. 1.—The mechanics of duct loss. Here we have a round pipe; a layer of cool air outside; a layer of warm air inside. Heat is lost through the metal from inside to outside.

for a given size duct at a definite velocity, but that it will be in error for other sizes and velocities. The error will be considerable for the smaller sizes which are often used in residence installations.

Recommended Solution

Experimental values for the temperature drop seem to be scarce so that the solution must be sought with the aid of the basic data on heat transfer. The mechanism of the heat loss is illustrated in Fig. 1, which shows a 1 foot length of duct. The heat lost by the air in travelling along this 1 foot of duct is transferred through the wall area. This may be expressed as

$$Q = M\, c_p\, t_d = U\, A\, (t_i - t_o) \text{ B.t.u./hr.}$$

from which

$$t_d = \frac{U\, A\, (t_i - t_o)}{M\, c_p} \text{ deg. F.}$$

where

t_d = temperature drop of inside air, F.
U = overall coefficient of heat transfer, Btu./(hr.) (sq. ft.) (F.).
A = duct area, sq. ft.
t_i = inside air temperature, F.
t_o = outside air temperature, F.
M = weight of air flowing, lb. per hr.
c_p = specific heat of air at constant pressure.

The area of a 1 foot length is πD (3.1416 times diameter) and the weight of air flowing is given by

$$M = 60\, V(\pi D^2/4)\, \rho \text{ lb./hr.}$$

in which

V = average air velocity, f.p.m.
D = duct diameter, ft.
ρ = air density, lb./cu. ft.

The duct diameter $D = d/12$, where d is expressed in inches. Also c_p for air may be taken as 0.24. Using these facts, the temperature drop per foot becomes

$$t_d = \frac{U\, (\pi d/12)\, (t_i - t_o)}{60\, V\, \frac{(\pi d^2/12^2)\, \rho\, 0.24}{4}}$$

$$= 3.33\, \frac{U}{Vd\rho}\, (t_i - t_o) \text{ F./ft.} \qquad (1a)$$

The temperature difference, $t_i - t_o$, often is near 100 degrees and the air density may be taken for about 140 F. air temperature in the duct for the usual heating system. When these changes are made

$$t_d = 3.33\, \frac{U\, 100}{Vd\, (0.0662)}$$

$$= 5030\, \frac{U}{Vd} \text{ F./ (ft.) (100 F. diff.)} \qquad (1b)$$

Expression (1b) gives the air temperature drop per 1 foot of duct length per 100 degrees difference in air temperature between the inside air temperature and the surrounding air temperature. It is also based on inside air temperature of 140 degrees F. but it will be sufficiently accurate for the usual fan heating applications where the temperatures used are not greatly different from 140 degrees F.. The duct diameter is

Mechanical Engineering Department, Georgia School of Technology.

expressed in inches and the air velocity in feet per minute.

Heat Transfer Data

The "piece de resistance" in equation (1b) is the overall coefficient of heat transfer. It is here that the fundamental heat transfer data must be turned to. The best presentations of these fundamental facts are probably those of W. J. King in March-August, 1932 issues of MECHANICAL ENGINEERING and the book of W. H. McAdams, HEAT TRANSMISSION, published by McGraw-Hill Book Co., 1933.

According to the usual method of calculating overall heat transfer coefficients

$$U = \frac{1}{\frac{1}{h_i} + \frac{1}{h_o + h_r}} \text{ Btu./(hr.) (sq. ft.) (F.).} \quad (2)$$

in which

h_i = inside air film conductance due to forced convection.

h_o = outside air film conductance due to natural convection.

h_r = outside radiation effect.

McAdams gives the expression for gases flowing in pipes as

$$h_i = 0.0269 \frac{c_p G^{0.8} \mu^{0.2}}{D^{0.2}} \text{ Btu./(hr.) (sq ft.) (F.).}$$

where

c_p = specific heat at constant pressure, (0.24 for air).

G = weight velocity, lb./(hr.) (sq. ft. of cross section) = $60\ V\varrho$

μ = absolute viscosity, lb./(hr.) (ft.).

D = diameter, ft.

This expression may be reduced to—

$$h_i = 0.018 \frac{V^{0.8}}{d^{0.2}} \text{ Btu./(hr.) (sq. ft.) (F.).} \quad (3)$$

where

V = air velocity, f.p.m.

d = duct diameter, in.

Equation (3) is based on an air film temperature of about 120 degrees F., which is about right when inside air is at 140 degrees F. Again, reasonable changes in air temperature will have a negligible effect on the inside air film conductance, h_i.

King gives for natural convection on the outside of pipes—

$$h_o = 0.23 \left(\frac{\Theta}{D}\right)^{0.25}$$

where

Θ = temperature difference between duct surface and outside air

D = duct diameter, ft.

In this case Θ may be taken as about 70 degrees F. when a 100 degrees F. difference occurs. The 0.25 power makes the effect of other temperature differences such as 50 degrees or 90 degrees F. negligibly small as far as h_o is concerned. Expressing D in inches rather than in feet gives—

$$h_o = \frac{1.24}{d^{0.25}} \text{ Btu./(hr.) (sq. ft) (F.).} \quad (4)$$

King states that the expression for h_o is only good up to about 1 foot diameter. However, the equation for flat surfaces up to about 3 feet is $h_o = 0.275 \left(\frac{\Theta}{D}\right)^{0.25}$ so that larger diameters can be satisfactorily handled by equation (4) for the purpose at hand.

The expression for the radiation effect of a surface which is small relative to its surroundings is—

$h_r = \Sigma F_t$

where

Σ = emissivity of surface

$$F_t = 0.174 \frac{\frac{(T_1)^4}{100} - \frac{(T_2)^4}{100}}{T_1 - T_2}$$

T_1 = surface absolute temperature.

T_2 = surroundings absolute temperature.

The emissivity of bright tin or galvanized ducts may be expected to be about 0.15 whereas if the duct is painted or covered with 1 layer of asbestos paper it may be about 0.90. The function of F_t will be approximately unity for a surface temperature of 70 degrees F. above the surroundings which has been used for h_o, in the range of temperatures discussed here. Thus radiation effect becomes—

h_r = 0.15 Btu./(hr.) (sq. ft.) for bright tin or galvanized (5a)

= 0.90 Btu./(hr.) (sq. ft.) for painted or 1 layer of asbestos paper (5b)

The values given by equations (3) (4) and (5) may be used for equation (2) now and give—

$$U = \frac{1}{\frac{1}{0.018 \frac{V^{0.8}}{d^{0.2}}} + \frac{1}{\frac{1.24}{d^{0.25}} + 0.15}}$$ for tin or galvanized ducts.

TABLE I

Overall Coefficient of Heat Transfer for Warm Air Ducts
Air inside at 140 degrees F., Air Outside at 40 degrees F.,
Btu./(hr.) (sq. ft.) (F.).

Duct Diameter	Air Velocity, f.p.m.			
in.	400	800	1200	2400
Bright Tin and Galvanized Sheet Metal				
4	0.635	0.757	0.82	0.90
8	0.551	0.658	0.71	0.78
12	0.505	0.600	0.65	0.71
24	0.440	0.520	0.56	0.62
Painted or Covered With 1 Layer of Asbestos Paper				
4	0.86	1.10	1.23	1.43
8	0.77	0.99	1.11	1.29
12	0.72	0.94	1.06	1.21
24	0.64	0.84	0.96	1.12

(*Continued on page* 42)

Forced Air Heating Facts From the Research Residence

By S. Konzo
Special Research Associate,
University of Illinois

In this article, the eleventh of the series, the author continues his explanatory articles on pressure measurements of air flow. The reader is referred to the previous three articles for a detailed discussion of the definitions of terms and the method of making pressure measurements.

Total Pressure

IN the previous three articles on the fundamentals of air pressure measurements the following points were emphasized:

1. Static pressures measurements do not always give a true indication of the resistance to air flow in a duct conveying air.
2. Static pressure measurements give correct indications of the friction resistance to air flow, only when the velocity of the air flow, at the two sections at which the measurements are made, are equal in magnitude.
3. The differences in total pressure, and not the static pressure, always give the true index of the frictional resistance or pressure drop in a duct system.
4. The total pressure at any point in a duct system is equal in magnitude to the sum of the static pressure and velocity pressure at that point.

Method of Measurement

With the rather condensed summary stated above as a basis, we can rapidly review the main features of the process of making pressure measurements in a duct system.

1. ***What instruments are necessary to make measurements of total pressure in a duct system?***

As was carefully explained in the previous article, measurements of total pressure can be most readily made by the method shown in Fig. 1. The pitot tube is inserted in the air stream so that the tube points directly into the air flow and the pressure is determined by means of a pressure gage, which can be of the inclined manometer type or any similar instrument. Ordinarily, readings should be made at more than one point in the air flow at a given station, and the average of several readings should be used as the value of the total pressure at that station.

2. ***Where are the measurements made in a duct system?***

For convenience in answering the second question, the duct system of a typical forced-air heating system is shown in Fig. 2 in simplified line diagram. The numbers 1, 2, 3, etc., refer to the stations where pressure measurements should be made if essential performance data are to be secured. It should be noted that pressure measurements can also be made at any point in the system other than at the places designated.

3. ***What do the pressure readings mean?***

Any number of pressure measurements can be made at any point in the duct system, but some measurements are of greater interest to the installer than are others.

For instance, it may be necessary to know the pressure loss in the return duct system, through the air filters, through the furnace casing, or in the supply duct system. Or perhaps it may be necessary to determine the resistance against which the fan is delivering its air. Any one or all of these

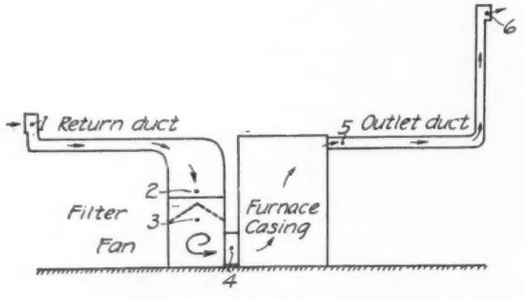


Fig. 1—Line diagram showing stations for observing total pressures in a typical forced air heating system. The numbers refer to stations.

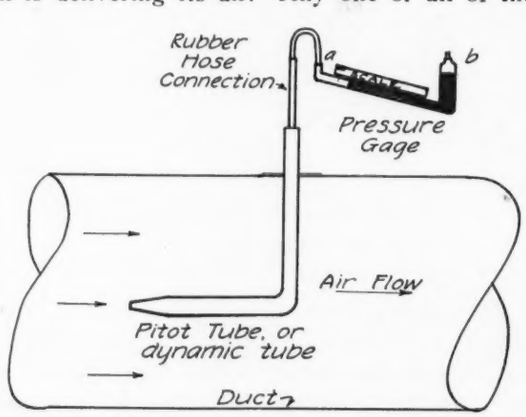


Fig. 2—Line diagram showing method of making total pressure determinations.

determinations can be made by obtaining the difference in total pressures between two stations.

For example, difference in total pressure between stations 1 and 2 give sthe frictional resistance to air flow in the return duct system; whereas, the difference in total pressure between stations 2 and 3 gives the pressure drop through the air filters.

Similarly, the differences in total pressures between stations 4 and 5 gives the pressure loss through the furnace casing, and the difference in total pressures between stations 5 and 6 gives the pressure loss of the supply duct system.

4. *Specifically, what would the readings made at station 5 and station 6 in Fig. 2 reveal?*

If the total pressures were determined at those two stations it will be found that for any given fan speed the gage reading for station 5 will be greater than that for station 6. Furthermore, as was explained previously, the difference in the two total pressure readings will be equal to the pressure loss due to the resistance of the duct, elbows, branches, dampers, risers, and obstructions between the two points, as well as the turbulence losses caused by sudden expansions and contractions of the air flow. In other words, these particular readings will enable the installer to determine the entire frictional resistance of the warm air outlet.

5. *Would this pressure loss determination enable the designer to check up on the performance of his plant?*

Primarily this determination of frictional resistance would show the designer how closely the actual values of duct resistance approached the assumed values. For instance, when the designer calculates the duct resistance from the best available data to be 0.06 inches of water, has he any assurance that the actual resistance will be 0.05 inches? or 0.25 inches? The only way of telling whether the design values are conservative or overly-optimistic is to actually measure the resistance in the actual plant.

6. *Is the pressure loss constant for all fan speeds?*

The pressure loss between stations 5 and 6 is dependent entirely on the quantity of air flowing through the given duct system. If the air quantity is large the losses are large; whereas, if the quantity is small, the losses are small.

7. *If the pressure loss is dependent on the air volume flowing, does the mere statement of a pressure loss for a duct system tell the whole story?*

If the pressure loss in a warm-air duct system, for instance, is stated as being 0.06 inches of water, the statement is incomplete. Under what conditions is it 0.06 inches? Is it with 1,000 c.f.m., or 5,000 c.f.m.? It is apparent then that one should state the loss only in reference to the air quantity. Let us assume that in this particular example the loss was 0.06 inches gage when 2,000 c.f.m. was being delivered by the fan.

8. *How would one conduct a series of tests to determine the pressure loss in a duct system?*

Obviously from the previous discussion, it is necessary to determine three items:

a. The fan speed, or the air quantity. The latter is preferable, but may be difficult to ascertain.
b. The total pressure at station 5. This should be made with the total pressure tube inserted in the warm-air duct quite close to the bonnet.
c. The total pressure at station 6. This should be made at the register face on the inside of the grille. For many installations this pressure will correspond to the velocity pressure at this point.

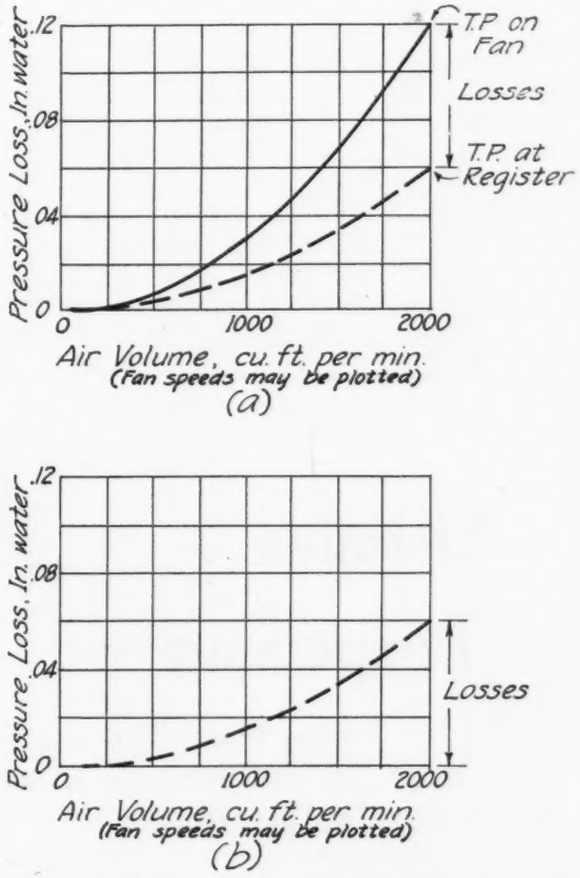


Fig. 3—(a) Typical curves showing total pressures in two parts of a duct system. (b) Curve of pressure losses derived from curves shown in part (a).

When these three items have been determined, the fan speed should be changed and the determinations of pressures and speeds should be repeated for the new speed. This process should be repeated for at least five separate fan speeds.

9. *How does one plot a pressure loss curve?*

Suppose, as a simple example, that the results of the complete test were as follows:

Fan Speed	Air Volume	Total Pressure Inches of Water	
R.p.m.	C.f.m.	Station 5	Station 6
200	1,000	0.030	0.015
250	1,250	0.048	0.024
300	1,500	0.070	0.035
350	1,750	0.092	0.046
400	2,000	0.120	0.060

(*Continued on page* 38)

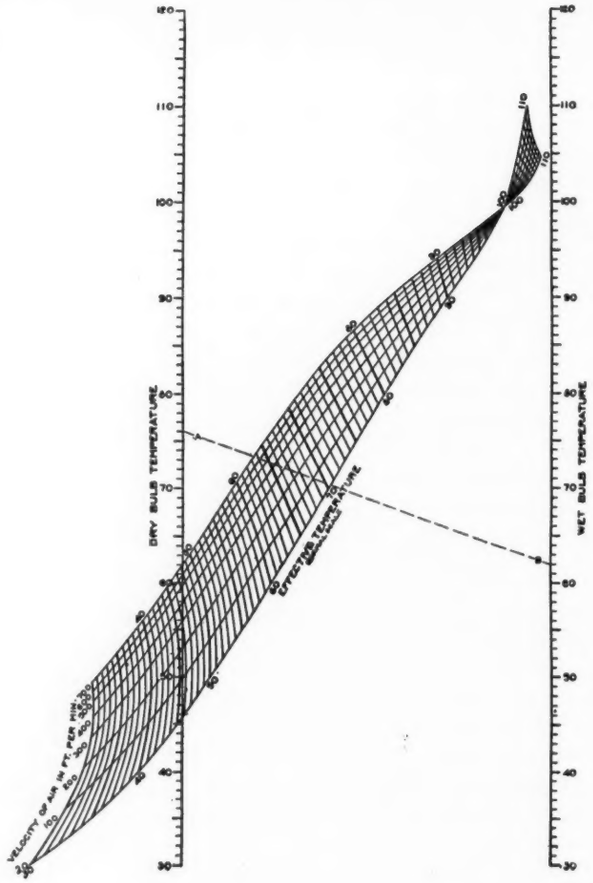


FIG. 1—THERMOMETRIC CHART SHOWING NORMAL SCALE OF EFFECTIVE TEMPERATURE. APPLICABLE TO INHABITANTS OF THE UNITED STATES UNDER FOLLOWING CONDITIONS:

A. Clothing: customary indoor clothing

B. Activity: sedentary or light muscular work

C. Heating methods: convection type, *i. e.* warm air, direct steam or hot water radiators, plenum systems.

Example in the use of the chart: Given dry-bulb temperature of 76 F, wet bulb temperature of 62 F, velocity of air 100 fpm; determine: (1) effective temperature of the condition, (2) effective temperature with *still* air, (3) cooling produced by the movement of the air, (4) velocity necessary to reduce the condition to 66 deg effective temperature.

Solution: (1) Draw line *A-B* through given dry- and wet-bulb temperatures. Its intersection with the 100-fpm curve gives 69 deg for the effective temperature of the condition. (2) Follow line *A-B* to the right of its intersection with the 20-fpm velocity line, and read 70.4 deg for the effective temperature for this velocity or so-called still air. (3) The cooling produced by the movement of the air is 70.4 — 69.0 = 1.4 deg effective temperature. (4) Follow line *A-B* to the left until it crosses the 66-deg ET line. Interpolate velocity value of 340 fpm to which the movement of the air must be increased for maximum comfort.

Effective Temperature—

What it is; how it was established; what it is used for; its relation to the "Comfort Zone" and comfort chart; and how to use it.

EFFECTIVE temperature is an index of warmth or cold. It is not in itself an index of comfort, as it is often assumed to be, nor are the effective temperature lines necessarily lines of equal comfort. This is true because in determining this index, the subjects compared not the relative comfort, but rather the relative warmth or cold of various air conditions. Moist air at a comparatively low temperature, and dry air at a higher temperature may both feel as warm as air of an intermediate temperature and humidity, but the comfort experienced in the three air conditions would be quite different, although the effective temperature is the same. The intermediate condition may be entirely comfortable, but the other two would not measure up to the same standard.

Under extreme humidity conditions there seems to be a difference between sensations of absolute comfort and proper degree of warmth. In other words, human beings are not necessarily comfortable when the air is neither too warm nor too cold. Air of proper warmth may, for instance, contain excessive water vapor, and in this way interfere with the normal physiologic loss of moisture from the skin, leading to damp skin and clothing and producing more or less discomfort; or the air may be excessively dry, producing appreciable discomfort to the mucous membrane of the nose and to the skin which dries up and becomes chapped from too rapid loss of moisture. According to the comfort experiments both at the A. S. H. V. E. Laboratory in Pittsburgh, and at the Harvard School of Public Health in Boston, effective temperature appears to be a fair index of comfort also, only within a humidity range of 30 to 60 per cent, approximately.

Briefly, effective temperature may be defined as an arbitrary index of the degree of warmth or cold felt by the human body in response to temperature, humidity, and movement of the air. Effective

temperature is not a temperature at all; it is a composite index which combines the readings of temperature, humidity and air motion in a single value. It has been called effective temperature because experiments showed that it is this composite index which initiates the physiologic effects produced in the body by heat or cold, regardless of the temperature, humidity and air movement components. The numerical value of the effective temperature index for any given air condition is fixed by the temperature of saturated air which, at a velocity or turbulence of 15 to 25 feet per minute, induces a sensation of warmth or cold like that of the given condition. Thus, an air condition has an effective temperature of 65 degrees when it induces a sensation of warmth like that experienced in practically still air of 65 F. saturated with moisture.

How to Use Chart I

In all reports of the A. S. H. V. E. Research Laboratory, the term still air signifies the minimum air movement that was possible to obtain in the Laboratory's psychrometric chamber. Actually, the air motion was between 15 and 25 feet per minute in all experiments. This was not a linear movement of air but it repreented the turbulence or eddy currents produced by the air change. Even in tightly sealed rooms, the natural air movement is not likely to fall below 10 feet per minute so long as there is a temperature or pressure difference between the air inside and outside the room.

Given the dry- and wet-bulb temperature and the velocity of air motion, the effective temperature may be determined from the thermometric chart (Fig. 1) or from psychrometric charts with the effective temperature lines for various air velocities superimposed. All these charts should be used specifically as effective temperature charts and not as comfort charts. Those showing the comfort zones for air velocities other than 15 to 25 feet per minute (often referred to as still air) should be redrawn, omitting the comfort zones for reasons explained later.

The thermometric chart (Fig. 1) applies to average normal and healthy persons adapted to American living and working conditions. Application is limited to sedentary or light muscular activity, and to rooms heated by the usual American convection methods (warm air, plenum and direct hot water and steam heating systems) in which the difference between the air and wall surface temperatures may not be great. The chart does not apply to rooms heated by radiant methods such as the British panel system, open coal fires, and the like. It will probably not apply with adequate accuracy to races other than the white or perhaps to inhabitants of other countries where the living conditions, climate, heating methods, clothing, etc., are materially different from those of the subjects employed in experiments at the A. S. H. V. E. Research Laboratory at Pittsburgh.

Limits of Comfort Zone, Comfort Line and Comfortable Humidities

According to the definition of the A. S. H. V. E. Research Laboratory, the extreme comfort zone includes air conditions in which one or more of the experimental subjects were comfortable. The average comfort zone includes those air conditions in which the majority of the subjects (50 per cent or more) were comfortable. That particular effective temperature at which the maximum number of subjects was comfortable was called the comfort line.

In some publications the comfort line for the winter season is placed at 64 degrees effective temperature, while in others it is put at 66 degrees effective temperature. Similarly the lower boundary of the average comfort zone is put at 61 degrees and 63 degrees effective temperature, and the upper boundary at 69 degrees and 71 degrees effective temperature.

In the original tests by the A. S. H. V. E. Research Laboratory two different scales of effective temperature were developed: the basic and the normal, and but one comfort zone. In determining the basic scale, the subjects were stripped to the waist to eliminate the complicated influence of clothing. In the normal scale, the subjects wore customary indoor clothing. This is the scale used in ordinary ventilation work. The basic scale is applicable to hot industries where men usually strip to the waist.

Changes in Comfort Zone

The winter comfort zone was determined in 1923 at the A. S. H. V. E. Research Laboratory from votes of men and women subjects, wearing customary indoor clothing. This was about one and a half years before the normal effective temperature scale was developed. For this reason, the comfort zone for persons normally clothed was temporarily superimposed on the basic effective temperature chart for persons stripped to the waist. On this basic scale, the limits of the average comfort zone were placed tentatively at 61 and 69 degrees and the comfort line at 64 degrees basic effective temperature.

In 1924 when the normal effective temperature scale was established, the laboratory recomputed the comfort zone data in terms of this new scale, and superimposed the zone on the new effective temperature chart where it belongs. According to this revision, the average winter comfort zone has been permanently fixed between the limits of 63 and 71 degrees effective temperature (normal), and the comfort line at 66 degrees effective temperature (normal). This explains the apparent discrepancy.

Insulation For House Construction*

By J. D. Hoffman
Professor of Practical Mechanics
Purdue University

[Part 6]

In the September issue Professor Hoffman discussed the important subject of attic heat loss. This can readily be explained to the home owner in terms of actual fuel dollars saved. This article takes a typical house and fuel and shows just how many dollars are saved by insulation (including the cost of the insulation).

A Brief Study in Heat Saving

AN application should now be made for the sake of clearness. This application will not be for the purpose of showing total heat losses from a room or rooms, but will rather touch upon savings which may be effected through various insulations applied to walls, ceilings, and floors.

Assume the following conditions: A new two-story standard framed house, having a net exposed wall surface of 1,700 sq. ft. and an attic floor surface of 700 sq. ft. The whole house interior is to be maintained at 70° F. from September 15 to May 15 (240 days = 5760 hours). Assuming the heating system to be calculated for zero weather, is it desirable, from the standpoint of economy, to insulate the walls and ceiling of this house? If so, what is the saving?

Assume, also, a good grade of soft coal, say, 12,500 B. t. u. per pound, valued at $8.75 per ton of 2,000 pounds, in the bin. The efficiency of the furnace combustion may be taken at 60 per cent, and the average heating day may be assumed to have approximately 40 per cent of the heat loss of the zero day. Now, if the standard framed wall is improved as in No. 4 insulation, there will be saved:

1700 x (.23–.09) x 70 x 5760 x .40 = 38,384,640 B. t. u. annually.

If No. 2 insulation is used in the wall, there will be saved 13,708,800 B. t. u. annually; or if No. 3 insulation is used, there will be saved 27,417,600 B. t. u. annually. These savings are equivalent, respectively, to 2.56, .91, and 1.83 tons of coal in the bin.

For the attic floor-ceiling combination, no serious error will be involved if the entire surface of the attic floor is counted as conducting surface; i. e., no reduction made for surface covered by joists. Some allowance should be made, however, for changes in attic temperatures. With a constant outside temperature, attic temperatures will fluctuate, according to the type of insulation in the floor-ceiling construction. For example, with lath and plaster only, there will be a rise, and with insulation added there will be a drop in the attic temperature. These values are not definite and must be obtained by observation.

Assuming then that on a zero day the attic air temperature is 35° for the type 11 (Fig. 14), 25° for type 12 (Fig. 17), and 20° for types 14 and 17 ceiling (Fig. 19), and that the ceiling air temperature below is 76°, what will be the saving for the heating season if type 11 is improved as in types 12, 14, or 17?

The heat loss from type 11 is 700 x .50 x (76–35) x 5760 x .40 = 33,062,400 B. t. u. The heat loss from type 12 is 700 x .24 x (76–25) x 5760 x .40 = 19,740,672 B. t. u. Therefore, type 12 is better than type 11 by 13,321,728 B. t. u. Also, type 14 is better than type 11 by 24,030,720 B. t. u., and type 17 is better than type 11 by 26,740,224 B.t. u. These savings represent, respectively, .89, 1.60 and 1.78 tons of coal in the bin.

Cost Summary

Summarizing the values of the heat saved by the various types of insulations, we have:

		Wall		Floor-Ceiling	
Items	Types	Coal, Tons	Dollars	Coal, Tons	Dollars
A	1 minus 4	2.56	22.40		
B	1 minus 2	.91	7.69		
C	1 minus 3	1.83	16.01		
D	11 minus 12			.89	7.78
E	11 minus 14			1.60	14.00
F	11 minus 17			1.78	15.58

For the application, compare wall types 1 and 3, and floor-ceiling types 11 and 14. From the summary this total annual fuel saving is $30.01.

In addition to the annual savings in fuel, there is a first-cost saving in the heating system installed. Since the heating system is estimated to supply heat for the coldest weather, the 1700 square feet of wall surface will have a maximum hourly heat loss on a zero day of:

Type No. 1 = .23 x 70 x 1700 = 27,370 B. t. u.

Type No. 3 = .13 x 70 x 1700 = 15,470 B. t. u.

The wall saving, in terms of steam radiation, is (27,370 — 15,470) ÷ 240 = 49.6 sq. ft.

Similarly, the 700 square feet of floor-ceiling will have a maximum hourly heat loss on a zero day of:

Type No. 11 = .50 x 41 x 700 = 14,350 B. t. u.

Type No. 14 = .10 x 56 x 700 = 3,920 B. t. u.

This saving, in terms of steam radiation, is (14,350 — 3,920) ÷ 240 = 43.5 sq. ft.

The saving in plant capacity due to insulation is, therefore, equivalent to 93.1 square feet of steam radiation. Allowing $2.00 per square foot of radiation installed as a fair valuation, we get $186.20 as a first-cost saving. The total saving for the first year, due solely to insulation, is $216.21, and the annual saving thereafter will be $30.01.

(*Continued on page* 40)

*Reprint of Extension Series No. 31, *Engineering Extension Department, Purdue University.*

Estimating Cost and Capacity of Air Conditioning

The following average figures for approximating the capacity and cost of air conditioning installations were given by E. B. Murray of E. B. Murray & Co., Kansas City, in his paper on air conditioning presented at the Cincinnati convention of the National Association of Building Owners and Managers. He pointed out that unusual circumstances entering into the installation will materially affect cost and capacity, but that correct factors to meet special cases can be applied to obtain at least a rough check. These figures, stated the speaker, have been applied in estimating a number of installations which were later checked and found to be correct within a small degree of variation:

To Estimate Tonnage Required—

Offices and Banks—0.3 ton per 100 sq. ft.

Restaurants—One patron per 15 to 20 sq. ft., to which must be added the number of employees. 0.1 ton per person.

Stores—0.325 tons per 100 sq. ft. (Factor is higher on account of heavy light load and frequency with which doors are opened.)

To Estimate Costs of Installation

Cost per ton for above ranges from $250.00 to $350.00 or for

Offices and Banks—$1.00 per sq. ft.

Restaurants—$1.30 to $1.50 per sq. ft.

Stores—$1.15 to $1.50 per sq. ft.

Operation Costs

Consumption—

1 kw. per hour per ton.

1 to 1½ g.p.m. water per ton.

Approximately 25c to 30c per day (ten hours) per ton total operations (electricity and water).

Repairs, renewals, labor not included.

A break down of the average installation cost is as follows:

Duct Work	25%
Fans and apparatus	35%
Refrigeration, coils, compressors	35%
Controls	5%
	100%

Another simple rule for determining the approximate tonnage required for various classifications, is as follows:

Types of Rooms	Cu. Ft. per Ton
Cafeterias and Lunchrooms	1000 to 1500
Barber and Beauty Shops	1200 to 1800
Dining Rooms and Retail Stores	1500 to 2000
Theatres	1800 to 2400
General Offices, Club Rooms, Funeral Parlors	2000 to 3000
Banks, Brokers' Offices, Private Offices and Residences	2500 to 4000

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Facts From Research Residence

(*Continued from page* 33)

The results can be plotted on a curve similar to that shown in Fig. 3a. Along the horizontal axis is plotted the fan speeds (or air volumes) and along the vertical axis is plotted the actual total pressure readings for stations 5 and 6. In the curves shown in Fig. 3a the horizontal axis has been marked off in terms of the air quantity. As noted in the figure, it would have been just as convenient to plot the fan speeds along the horizontal axis. The total pressure readings at station 5 are always greater than those at station 6. In other words, in Fig. 3a, the curve for "total pressure at the fan" is greater in magnitude than the curve for "total pressure at the register" for all air volumes.

10. ***What are the characteristics of a pressure loss curve?***

As stated before, the loss in pressure in the warm-air duct system is equal in magnitude to the difference in total pressures between the two points. For sake of clarity, that difference in pressure has been plotted separately, as is shown in the lower curve which is designated as Fig. 3b.

One characteristic of all pressure loss determinations, whether it be for that of a duct system, air filter, casing, or elbow, is that the pressure loss does not vary directly in proportion to the air volume being handled. The pressure loss does not, for instance, double in value when the air volume is doubled.

As may be determined from an examination of Fig. 3b, and the data in the table, if the air volume is increased from 1,000 c.f.m. to 2,000 c.f.m. the pressure loss is increased from 0.015 inches to 0.060 inches. In other words, by doubling the air volume through the duct system the pressure loss is quadrupled. Similarly, it will be found that if the air volume is tripled, the pressure loss of a given system will be increased nine-fold.

In more exact terms this relationship has been expressed as follows:

"The losses are proportional to the square of the velocity."

Relation of Pressure Losses to Fan Ratings

Before proceeding to the discussion of the losses in an actual duct system, it might be well at this point to review very briefly the reasons for making any assumptions at all in regards to the magnitude of the pressure losses in a duct system. The question and answer method, which was used in the preceding question will again be resorted to by the author.

1. ***Why is the designer of a forced-air heating system concerned with pressure losses?***

The designer is usually interested in magnitudes of pressure losses because they serve a two-fold purpose. Firstly, they enable the designer to size the ducts in a given installation so that any one duct or branch will not have an unusual amount of resistance to air flow, as compared with the other ducts in the same installation. Secondly, they enable the designer to select a fan which will be cap-

able of delivering the required air volume against resistance.

2. ***So much emphasis has been placed on the pressure losses in a forced-air system, that one would suppose that pressure losses are unique to that system. Does the gravity warm-air system also have a pressure loss?***

Pressure losses are by no means something new for the heating man to consider. Even the relatively simple gravity warm-air furnace system is governed by pressure heads and pressure differences, but the fact has been generally overlooked. For instance, the resistance existing in a gravity

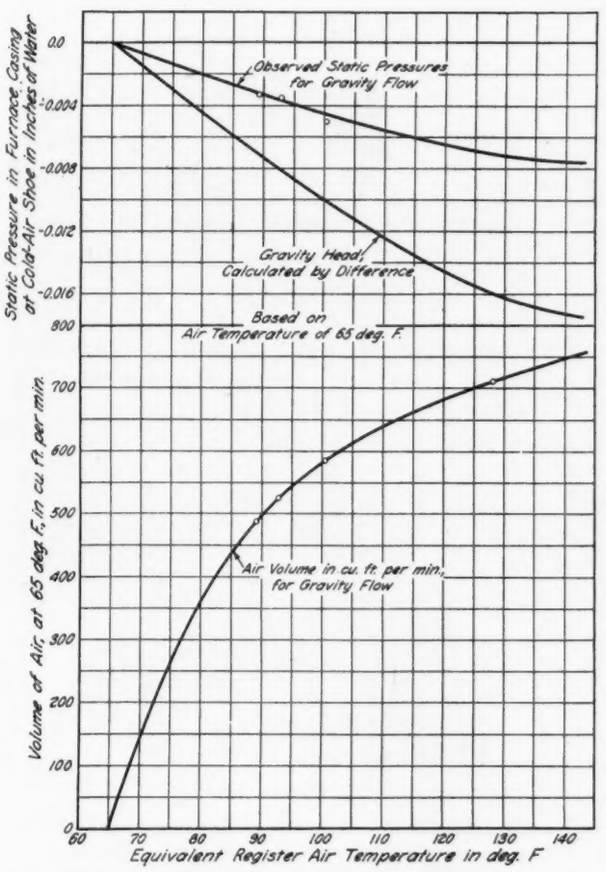

Fig. 4—Static pressures at bottom of furnace casing with gravity operation in ninth installation.

warm-air furnace can be illustrated by the top curve in Fig. 4, which shows the static pressures existing at the bottom of the casing for various register temperatures. It should be noted that the motive head for creating the flow of air in a gravity system is produced by the temperature difference that exists between the register outlet and the casing inlet. In other words, the air flow in a gravity system is created by a "suction" that tends to draw the air through the casing. This statement is confirmed by the top curve in Fig. 4, which shows that the static pressure in the furnace casing was negative, or below atmospheric pressure, and hence a "suction." Furthermore, it may be noted that the magnitude of the suction was less than 0.01 inch of water.

On the other hand, the static pressures or total

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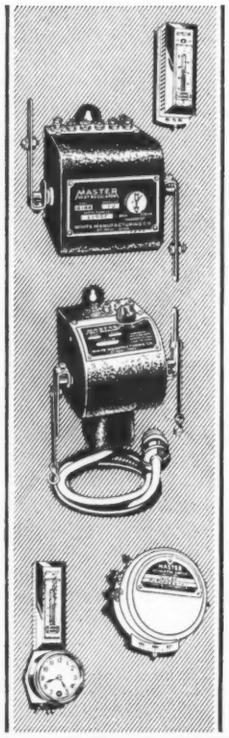

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pressures in a forced-air system are positive in character and very much greater in magnitude than those for a gravity system. Whereas the air in a gravity system is "drawn through" by a very slight pressure difference, the air in the forced-air system is "pushed through" by means of a fan. In one respect, however, both systems are alike, since any resistance in the duct system tends to decrease the pressure head available for moving the air. We may state as a generalization, therefore, that pressure losses are nothing new to the heating man or the furnace dealer.

3. ***If one specifies that a fan is needed to deliver 2,000 c.f.m. in a given installation, does that information alone enable one to select a fan?***

Obviously, the fan must be capable of delivering air against whatever pressure exists in the given installation. One installation may require a fan capable of delivering 2,000 c.f.m. against a pressure loss of 0.25 inches gage, whereas another installation may require a fan capable of delivering the same quantity of air against a resistance that is twice as great. Fans should be selected, therefore, to deliver a given volume of air against a stated pressure loss.

4. ***Is a fan having a large "free air delivery" better than a fan having a much lower delivery against some stated pressure?***

The reason for the insistence on the part of the author that fan deliveries should only be stated with reference to the pressures, against which it must deliver the air, is because there seems to exist some confusion in the trade about fan ratings based on "free air delivery." Fan ratings that are based on "free air deliveries" or "deliveries against zero pressure" are relatively worthless for fans which are to be installed in forced-air installations.

Hoffman On Insulation

(*Continued from page 36*)

On the other hand, insulation costs money. What would be the approximate cost, therefore, of the insulation just specified? Cost estimates will vary in different parts of the country, but the following will be fairly satisfactory for cities and towns in the central sections of the country:

One-half-inch quilted insulation, with materials for fastening to studs, per sq. ft. .	$0.06½
Labor installing quilted insulation, per sq. ft.	.01½
Rockwool, 3½ inches thick between joists, per sq. ft.	.07
If a greater thickness than 3½ inches is desired, estimate on the basis of 8 pounds of Rockwool to the cubic foot of space, and $60.00 per ton for the material.**	
Labor, filling in Rockwood, 700 sq ft. (est.)	20.00
From these data the	
Cost of wall insulation (1700 sq ft.) is. .	$136.00
Cost of attic floor insulation (700 sq. ft.) is	69.00
Total cost of insulation	$205.00

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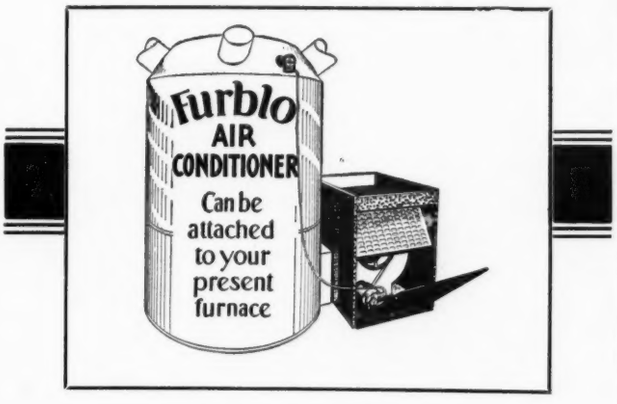

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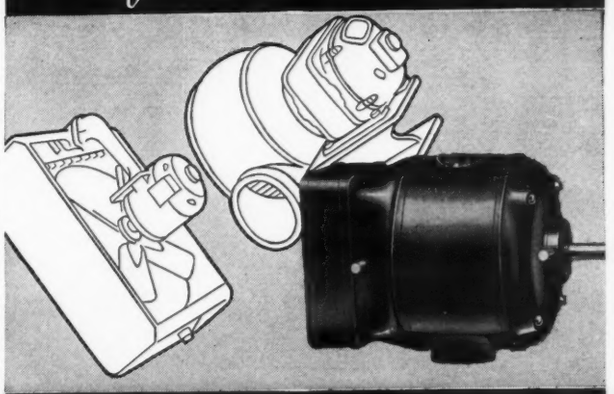

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Duct Temperature Loss

(*Continued from page* 31)

$$= \frac{1}{\frac{1}{\frac{V^{0.8}}{0.018\,d^{0.2}}} + \frac{1}{\frac{1.24}{d^{0.25}} + 0.90}}$$

for painted or 1 layer of asbestos paper.

Substitution of these values for U into equation (1b) with the proper velocities and diameters gives the values in Table II.

TABLE II

Temperature Drop in Warm Air Ducts, Air Inside at 140 Degrees F. per Linear Foot per 100 degrees F. temperature diff.

Duct Diameter	Air Velocity, f.p.m.			
in.	400	800	1200	2400
Bright Tin and Galvanized Sheet Metal				
4	2.0	1.2	0.86	0.47
8	0.86	0.52	0.37	0.20
12	0.53	0.31	0.23	0.12
24	0.23	0.14	0.10	0.05
Painted or Covered With 1 Layer of Asbestos Paper				
4	2.7	1.7	1.3	0.75
8	1.2	0.78	0.58	0.34
12	0.75	0.49	0.37	0.22
24	0.34	0.23	0.17	0.10

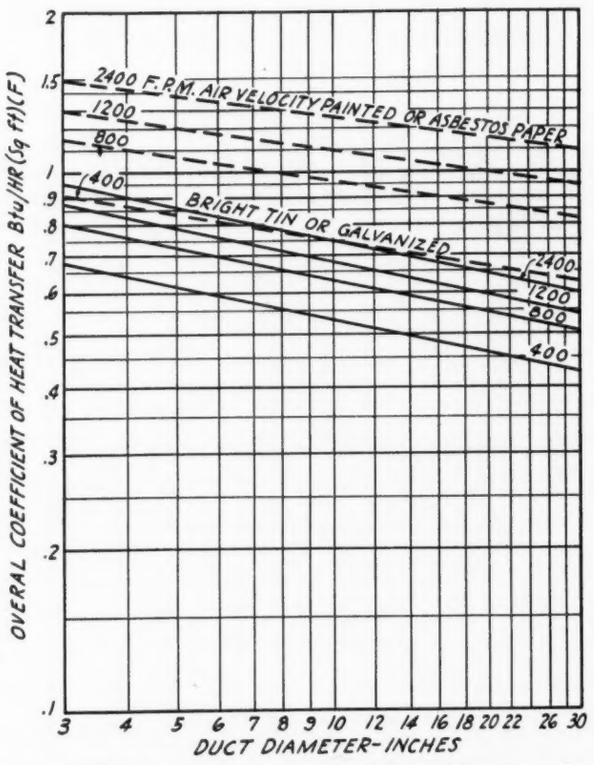

Fig. 2.—This chart will give the coefficient of heat transfer for different velocities and different duct materials. Select diameter at the bottom, move up to intersect velocity and material, move left to get coefficient.

Figure 2 is drawn to permit those interested in heat transfer to see the magnitude of the overall coefficients for this type of work. Also Fig. 2 was drawn

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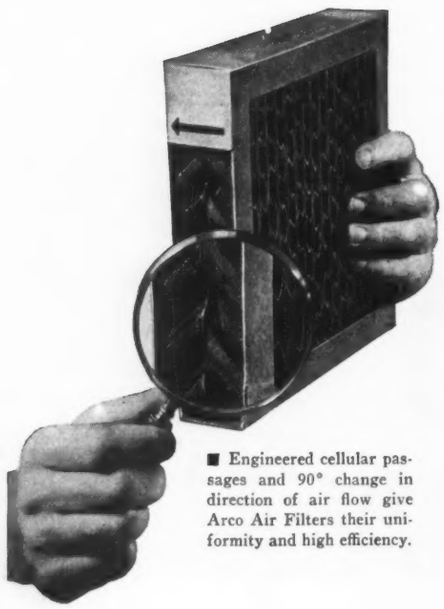

■ Engineered cellular passages and 90° change in direction of air flow give Arco Air Filters their uniformity and high efficiency.

THE Arco Air Filter has been designed to have uniform low resistance and high dust collecting capacity. To combine these fundamental requirements it was necessary that our designing engineers find a medium with tubular passages and of a material which would have ability to absorb and hold large quantities of adhesive. All of these features were found in corrugated straw-board of which the Arco Air Filter is made.

Because of the character of this straw-board, dirt as it collects in the filter becomes impregnated with the adhesive and thus in itself acts as additional filtering media. This is due to the large storage of oil which is pulled from the board to the dust by capillary action. Because of the additional filtering surface thus obtained, the Arco Filter increases in efficiency with use.

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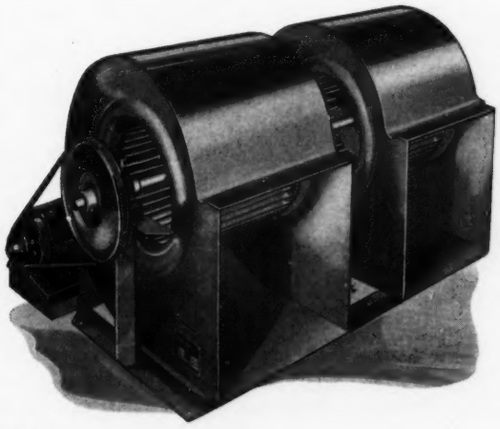

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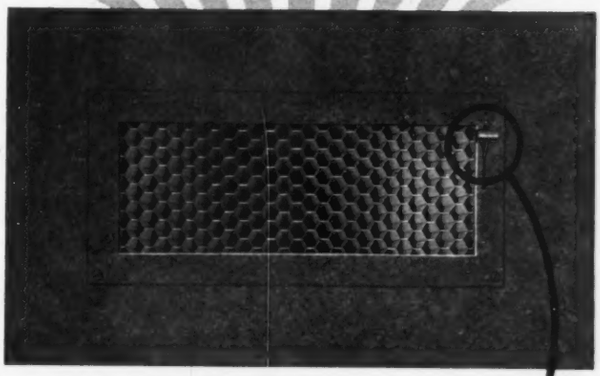

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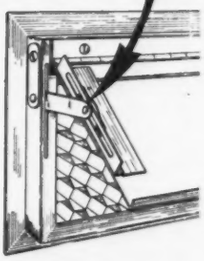

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Due to the tubular shape of the grille openings and to the depth of the grille, the duct back of the grille is effectively concealed. The valve operating handle located in the margin of the grille face leaves the mesh entirely unobstructed. When used with the H & C three-piece frame, installation may be made flush with the plaster and the grille face may be decorated in conformity with the walls.

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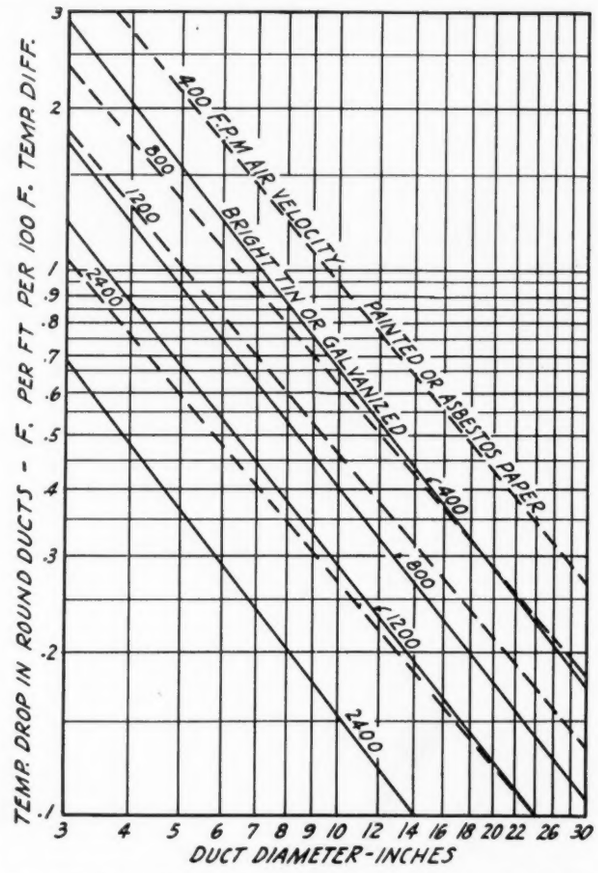

Fig. 3.—Here we find the temperature drop in round ducts in degrees F. per foot of duct per 100 degree temperature difference. To read select diameter below; move up to intersect velocity-material diagonals, move left to read temperature drop; reduce to actual duct length.

to see if the values of U were reasonable in the light of other experience with overall coefficients.

Table II and Fig. 3 give the final recommended values of the air temperature drop per foot of duct per 100 degrees F. temperature difference between the air flowing in the duct and the surroundings.

It should be noted that the temperature drops indicated in Fig. 3 should be based on the average temperature difference for a given length of duct if best accuracy is to be maintained. Thus if the temperature drop for a 50-foot length of 10-inch bright tin duct carrying air initially at 140 degrees F. with an 800 f.p.m velocity, is desired, and the surrounding space is at 40 degrees F, the estimated loss is given on Fig. 3 as 0.4 degrees F. per foot per 100 degrees F. difference. The estimated average inside temperature would be $\frac{140 + (140 - 50 \times 0.4)}{2}$ or 130 degrees F. which makes the average difference 130 — 40 or 90 degrees F. The temperature drop will be $50 \times 0.4 \times 90/100$ or 18 degrees F. Ordinarily for runs of about 50 feet or less, sufficient accuracy is obtained by simply using the initial air temperature instead of the average. In this case the drop would be given as $\frac{(140 - 40)}{100} \times 0.4 \times 50$ or 20 degrees F. instead of 18 degrees F. This is well within the accuracy re-

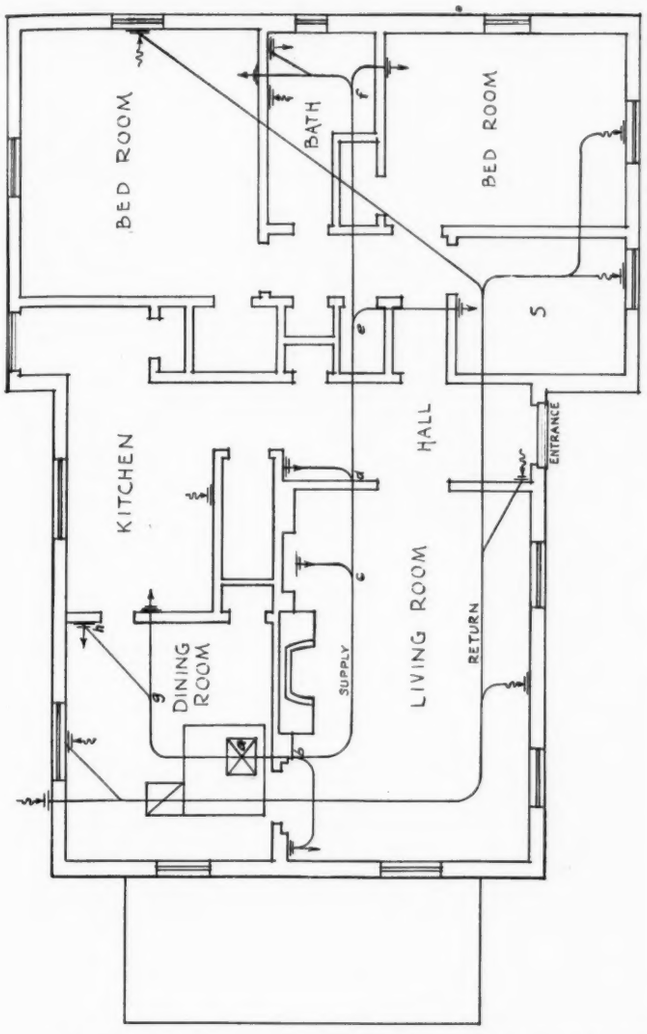

Fig. 4.—This typical basement piping plan is used to calculate the temperature losses in the ducts. The calculations are shown in Table 3 in the text.

quired since the conditions governing the heat loss are such that they are usually not known with a high degree of exactness.

Loss for Rectangular Ducts

If the film conductances for rectangular ducts are substantially the same as for flat surfaces, then it may be expected that the temperature loss will be closely equal to that of round ducts having the equivalent friction loss per foot. Since it is now the practice to compute the round sizes first and then take the equivalent rectangular sizes from tables or charts which give the same friction loss per foot, the temperature loss may be taken as for the round sizes without inconvenience.

Experimental verification of this conclusion would be of interest. It is based on the fact that film conductances for flat surfaces are approximately of the same magnitude and although the radiation effect is somewhat greater due to a greater area, other uncertainties of the orientation of the duct with respect to its surroundings do not warrant small corrections.

Illustrative Example

A diagrammatic sketch of the supply and return ducts for a small residence air conditioning system is shown

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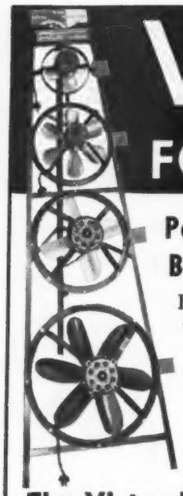

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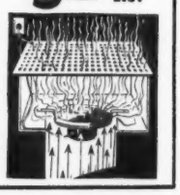

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TABLE III
Calculation of the Temperature Drop in a Trunk Duct System

Section	Diam. in.	Velocity f.p.m.	Unit Temp. Drop, F.	Length ft.	Temp. Drop in Section Degrees F.				Temp. at a =150
a - b	14	800	0.26	2	(0.26)	(2)	(150-30) / 100	= 0.6	b = 149.4
b - c	13	800	0.28	12	(0.28)	(12)	(149-30) / 100	= 4.0	c = 145.4
c - d	12	750	0.35	5	(0.35)	(5)	(145-30) / 100	= 2.0	d = 143.4
d - e	11	750	0.40	8	(0.4)	(8)	(143-30) / 100	= 3.6	e = 139.8
e - f	10.5	700	0.48	12	(0.48)	(12)	(140-30) / 100	= 6.3	f = 133.5
a - g	8	1000	0.45	6	(0.45)	(6)	(150-65) / 100	= 2.1	g = 147.9
g - h	6	750	0.8	5	(0.8)	(5)	(147.9-65) / 100	= 3.3	h = 144.6

Table 3—Calculations for duct temperature drop for the house in Fig. 4.

in Fig. 4. The heater room under the dining room is finished, with the rest of the space under the floor unexcavated and ventilated with cast iron wall ventilators. The ducts in the heater room are rectangular in order to conserve head room. All others are round bright tin and are designed for the trunk system, using the constant friction loss per foot method for sizing. A velocity of approximately 800 f.p.m. is the design figure. The location is in Atlanta where +10 degrees F. is the winter design temperature. Under these conditions the temperature surrounding the supply duct in the unheated area may be taken as 30 degrees F.

The temperature drop in each portion of the supply duct is given in Table III. These detail calculations are given to illustrate the use of the data shown in Fig. 3 and not to recommend that this be done for a system as small as this one. It is entirely satisfactory to take 0.4 degrees F. per foot of duct for this system rather than making a detail calculation.

The purpose of this discussion has been to present a method which will permit the rapid estimation of the temperature drop in ducts of known size, air velocity, surface finish and temperature difference. The data may be applied to either the trunk or individual duct systems and it is believed to be sufficiently accurate for both round and rectangular shapes.

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MONARCH *Non-Clog* AIR-WASHER NOZZLES

Impurities small enough to pass orifice of this nozzle will never clog lead hole. Spray is evenly distributed, not heavy on one side and light on the other. Inexpensive and highly efficient.

The ⅜" Fig. 629 (shown) and ¼" Fig. 631 (not shown, female pipe) are available in ten capacity sizes — 4.3 5.6, 6.7, 10, 24, 37, 56, 80 and 120 G.P.H. at 40 lbs. pressure.

For humidifying work the ¼" Fig. H-261 male pipe thread brass nozzle (not shown) is available in capacities from .57 to 18.17 G.P.H. at 40 lbs.

Write for Catalog 6-C and Bulletin No. 20

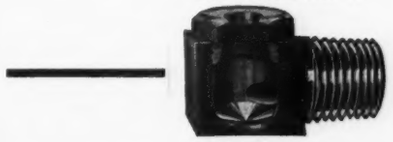
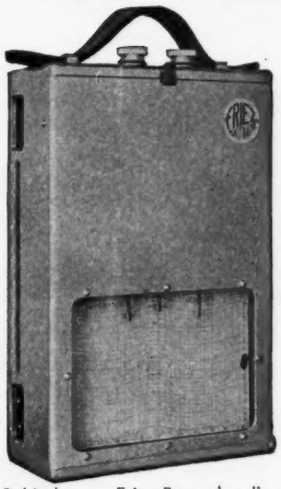


Fig. 629

MONARCH MFG. WORKS
3303 SALMON ST. PHILADELPHIA, PA.

HUMIDITY, TEMPERATURE, OPERATION TIME
All are available in the

NEW FRIEZ RECORDER



ANY combination of functions available. Charts on index file cards with space on back for simultaneous recording of general data. Easily portable. (Wt. 52 oz.) Very compact. (Size 8½" x 5½" x 2¼"). Rugged, sensitive and reliable. An ideal instrument for all concerned with air conditioning, heating, ventilating, refrigeration, and for many industrial applications. Unique and embodying up to the minute instrument practice at particularly reasonable prices.

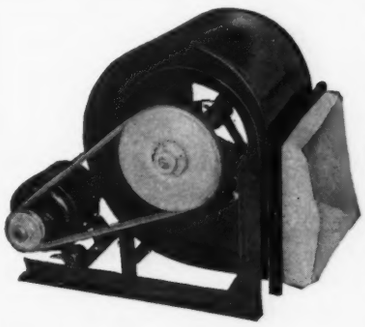
Priced from
$45.00
list.

Behind every Friez Recorder, lie 59 years of instrument making for U. S. Weather Bureau, Navy, etc.

Apply for details of our complete line of instruments for control, indication, and recording of air conditions for all purposes. Attractive Bulletins on request.

JULIEN P. FRIEZ & SONS, INC.
(A Subsidiary of the Bendix Aviation Corporation)
Baltimore, Maryland

Peerless Blowers For Air Conditioners

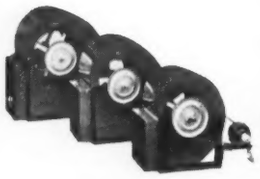


When you buy a Peerless Blower you get a blower that is completely manufactured in our own plant. The motor has been especially designed to drive that blower. A special rubber mounting and an automatic belt tension device are features. Peerless Blowers move more air at less cost. May we figure your requirements?

Special Motors or Blowers to Meet Your Specifications

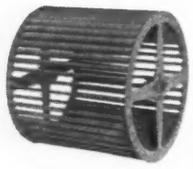
THE PEERLESS ELECTRIC COMPANY
FAN & BLOWER DIVISION
DEPT. "E" WARREN, OHIO

INVESTIGATE
THE **HY-DUTY** LINE



BLOWERS FOR
FORCED AIR FURNACES,
AIR CONDITIONING,
COMPLETE UNITS OFFERED
With Motor Pulley and Belts

MULTI-BLADE BLOWER FANS



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LIGHT WEIGHT
LOW STARTING TORQUE
DYNAMICALLY BALANCED
NO VIBRATION
SINGLE AND DOUBLE INLET
TYPES FROM 4¾-IN. TO 20-IN.
DIAMETER, ANY WIDTH

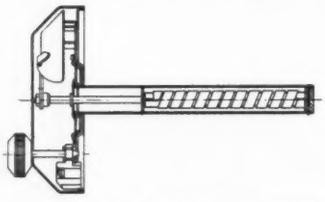
PILLOW BLOCKS

QUIET, SELF-ALIGNING
LONG BEARING LIFE
OIL RESERVOIR FOR SEASONS
OPERATION
For ¾", ⅞", 1", 1 1/16" DIA. SHAFT

CONSULT US FOR YOUR REQUIREMENTS

SCHWITZER-CUMMINS COMPANY
MASSACHUSETTS AVENUE AT FAN STREET
INDIANAPOLIS, U. S. A.
MANUFACTURERS OF BLOWER AND PROPELLER FANS

Accurate Control of Furnace Heat can be accomplished by this "Diamond H" Thermostat



A DIRECT BREAK INDICATING THERMOSTAT
for

Fan Control—To start furnace at a desired temperature and to shut off fan when heat is below this temperature.

Limit Control—To turn off burner or close damper when temperature rises above temperature set.

Safety Control—To start fan in case of failure of burner or damper, when temperature rises above safety point.

Bulletin No. 13-A describes these thermostats. Copy sent on request.

Air Conditioning—We furnish mercury tube relays for various controls in air conditioning equipment.

The HART MFG. CO., Hartford, Conn.

DIAMOND H SWITCHES

Temperature and Humidity

(*Continued from page 27*)

we opened up the sponge-like ability of the air to hold moisture. 70 degrees is about the temperature of our homes. Health authorities advocate 50 per cent relative humidity to be maintained all winter.

Let us consider a five-room bungalow containing 10,900 cubic feet of air. To maintain a relative humidity of 50 per cent with a temperature of 70 degrees F. we will have to evaporate 10,000 times 4 grains of water per cubic foot or 40,000 grains of water for this bungalow. As one pound of water contains 7,000 grains we will need to evaporate 5.70 pounds or about two and three-quarter quarts of water per hour. Allowing for a drop of temperature at night when the fire is banked, the average evaporation of water per day will be about ten gallons.

Humidifiers

There are many very efficient humidifiers on the market. In the quest of a device one should be sure to check its capacity with reference to the size of the building or amount of space to be humidified, just as one would have the heat loss calculated for each room in heating.

One would not attempt to heat a public school with a bungalow size heating plant. The same sort of careful calculation for a humidifier is just as important because it deals with the cubical content of air space which is also heated.

Caution must be observed in selecting a humidifier and we should not expect some novelty about

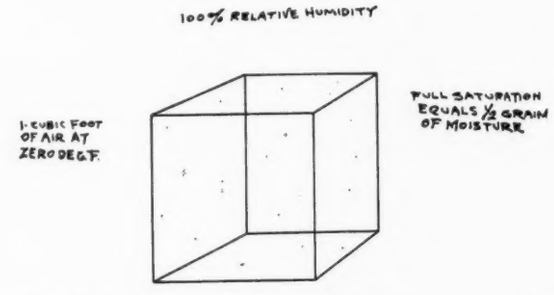


Fig. 3—If our cubic foot is dropped to zero temperature it can hold only ½ grain of moisture. But it is still 100% saturated. Thus we see the effect of temperature.

the size of a coffee percolator capable of holding about one quart of water, having an electric heating element attachable to a light socket, to handle any more space than a cigar counter.

The Air Washer

The air washer as a humidifier has advantages beyond a mere water cooker or evaporator in that it not only adds the proper amount of moisture to the air in winter, but also cleanses or washes out dust and odors of the air passing through it. Another advantage is that in this form of humidifier

SAFETY AND HOME OWNERS' SATISFACTION--

Two essential requirements towards your success in selling controls for Domestic Furnaces.

- Cook Heat Control provides complete safety by closing the draft and opening the check door in event of any current failure.
- Fully Automatic Firing Clutch.
- Noiseless operation—No radio interference—No service—
- Efficient—Rugged, built to last a lifetime.
- For Gravity or Forced Air Installations.

Insure your reputation and build up a profitable business with the moderate priced, quality Cook Heat Controls.

Write for Cook "Dealers Opportunity in Heat Control"

COOK ELECTRIC CO.
2700 Southport Avenue, Chicago

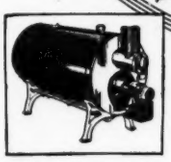
INSTALL IT FORGET IT!

That's what you do with a
CHAMBERLIN AUTOMATIC HUMIDIFIER

Cast all in one piece in either cast iron, baked enamel finish or cast aluminum. Back circulation of heated water to cause liming troubles eliminated by special trap cast integral. New type, trouble free valve entirely out of water. Constant water level automatically maintained. Priced to sell. Quickly and easily installed in any furnace. Pioneered and successfully manufactured since 1925. Write for literature and prices.

Manufactured by

CHANDLER COMPANY
CEDAR RAPIDS, IOWA



Nu-Way "Genii" Automatic Hot Water Heater

Easy to install. Efficiency 50% to 70% saving over gas in most communities.

Burns Number 1, 2, or 3 Fuel Oil. A quality product.

Consider Nu-Way

The reputation of every oil burner dealer is dependent upon the product he installs in his territory.

Future sales, replacement jobs and good will are all built upon the service you deliver in your sales of today.

If you expect to continue in business for ten years or more, we ask you to consider Nu-Way.

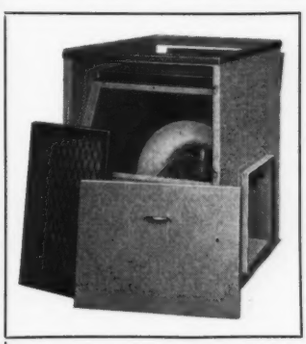
Nu-Way automatic oil burners have always been built to deliver the maximum service.

A Nu-Way franchise has proven valuable to many old reliable oil burner dealers throughout the United States.

Write today and let us prove to you why you should consider Nu-Way—one of America's old reliable quality oil burners.

The NU-WAY CORP. ROCK ISLAND ILLINOIS

A NEW AND IMPROVED LAU PACKAGE UNIT



Dealers throughout the country are enthusiastic about the sales possibilities of this New Lau Package Unit. It combines everything that makes for greater sales . . . for better service . . . and for simplified installation.

It is only 27½ inches from front to back . . . the reversible motor can be placed on either side on the job . . . special filter frames prevent air leakage . . . all air used for summer cooling is filtered . . . blower is centrifugal type, absolutely silent . . . felt strips replace canvas for the blower-cabinet connections . . . full size access door on each side . . . and exceptionally beautiful in design and finish. It's a sure seller, and now is the time it can be sold. Profit with Lau. Get complete information at once.

LAU HEATING SERVICE, INC.
Dayton, Ohio

all the air of the space to be humidified is in motion; silent fans continuously re-circulate the air through the air washer type humidifier.

Let us consider cooling and de-humidifying the home on hot, sweltering days of summer. Under these conditions nature's garment of warmth, our body moisture, cannot be given off to the air because the air is already highly humid. Consequently our body moisture runs down our bodies in the form of perspiration.

Condensation

The removal of moisture from air is accomplished by condensation (just the opposite of adding moisture by evaporation). Let us again consider our cubic feet of air at 70 degrees F. and with 8 grains of moisture invisibly suspended therein. Now let us cool this cubic feet of air to 50 degrees F. at which temperature it can hold only 4 grains of moisture. What happens to the other 4 grains of moisture as we squeeze the sponge by lowering the temperature of the cubic feet of air? Four grains of moisture will precipitate out in tiny droplets of water in solid form and be ready to run down away from this cubic foot of air.

Dew Point

We must now consider Dew Point. This is the temperature of saturation, or the temperature at which a given body of air becomes saturated without the addition or subtraction of any moisture. If our cubic foot of air heated to 70 degrees F. contained 4 grains of moisture, representing 50 per cent relative humidity, and we dropped the temperature to 50 degrees F., the 4 grains of moisture would then represent 100 per cent relative humidity, or the exact point at which dew is about to form. The temperature of saturation is called the dew point because it is the temperature at which moisture begins to condense in the form of tiny drops of water or dew.

Now let us consider one of those dog days of July or August. On such a day our dehumidifier must cool the air by lowering its temperature. We do this by moving the air of the room through the device. Since there is no such thing as "cold" because cold is negative and heat is positive, air can be cooled only by passing it through a cooling surface which extracts the heat from the air as it passes through. In so doing the moisture carried by the air in its passage through such a device is left behind.

A Problem

Going back to our cubic foot of air let us say it has a temperature of 85 degrees F. and contains 10 grains of moisture on a hot summer day of high

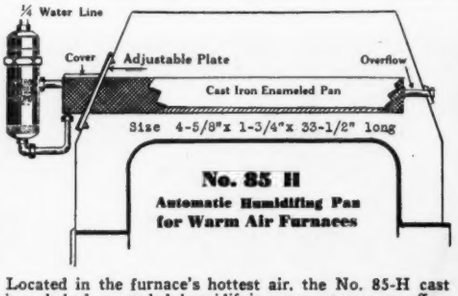
(*Continued on page* 52)

Stop Watching the Water-line

Make-shift humidifiers no longer have a place in the picture. The new era of Air-Conditioning has created a new demand of humidifying equipment. It must respond properly and promptly with heating requirements. It should be designed to avoid corrosion. It should be float controlled. Because the WATER-BOY perfectly meets these requirements, many manufacturers and contractors have adopted it as standard equipment. A sample will likewise convince you. Order today.

Send for Circular 16 and prices

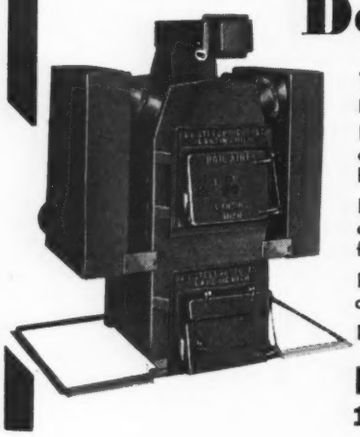
MAID-O'-MIST, Inc.
Wm. J. Woolley, Pres. 43 E. OHIO ST. CHICAGO, ILL.



No. 85 H
Automatic Humidifing Pan for Warm Air Furnaces

Located in the furnace's hottest air, the No. 85-H cast iron baked enameled humidifying pan proves an effective and dependable unit. It is supplied with water through the reliable No. 85 WATER-BOY, which maintains a constant shallow body of water in the pan at all times. It is furnished complete with all fittings, flanges, etc., as shown, excepting the ¼" overflow pipe.

List Price complete as shown $10.00



Don't Be Fooled By Looks

When you decide on a line of heating and air conditioning is not all that counts—It will pay you to look inside the casing and find out how efficient and modern the heating plant is.

It is easy to put a beautiful casing on a 1910 model furnace, but what you should sell your customer to uphold your reputation as a dealer of honest merchandise is a line that will give better efficiency, more service and longer life.

Dailaire casings have the appearance—They are well designed and beautiful, and inside the casing is a 1935 model, modern efficient heating plant, with large radiating surfaces with down flue travel.

Dailaire has 5 years of actual field operation and a record from users of fuel operating costs that will surprise you.

Dealer territories are open—Write for full information on Dailaire today.

DAIL STEEL PRODUCTS COMPANY
1050 Main St. **Lansing, Mich.**

PRACTICAL THERMOMETER HELPS CLOSE PROSPECTS

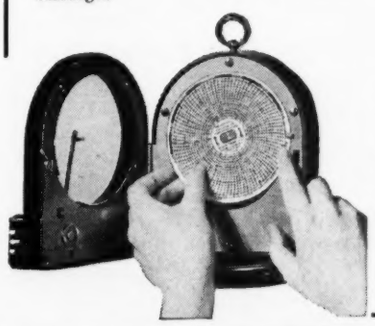
Write for Information

The *results* your equipment gives are what interest your prospects. With the Practical Thermometer you *prove* good results and can show the prospect temperature records of your equipment in operation.

Other dealers are doing it. You can too. Simply run a Practical 24-hour record before and after each installation. Use the 2 charts you get to prove good heating. In that way convince other prospects.

Practical Thermometers are used to check installations, help sell, forestall complaints, record service work, aid collections. Write for a complete list of 14 Ways to use Practical Recording Thermometers. Just say, "Send Information."*

Dept. 14, Practical Instrument Co., 2717 N. Ashland, Chicago.



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For furnace manufacturers who buy wheels only, Clarage offers any size desired, and can meet any quantity requirement. Clarage Wheels can be furnished standard width, or any percentage of standard width to deliver a specified volume of air at any operating speed. All wheels are PERFECTLY BALANCED for quiet operation without vibration.

Clarage Furnace Fans (complete assemblies) combine many advantages. They are positive centrifugal type, very compact, highly efficient, and the low speeds insure SILENT OPERATION. Inlets and outlets are drilled with holes for easy attachment to ducts.

Clarage Fan Company, Kalamazoo, Michigan

CLARAGE
Air Handling and Conditioning Equipment

The Big Name in
HEATING and AIR CONDITIONING
is
MUELLER-MILWAUKEE

STANDARD HUMIDOSTATS

for

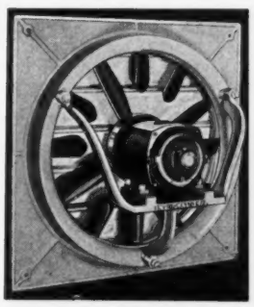
Dependable Control of humidity. Attractive Bakelite cover. Be prepared for coming business. External lever adjustment.

List Price **$15.00**

Write for discounts

The Standard Engineering Works
289 Roosevelt Ave. Pawtucket, R. I.

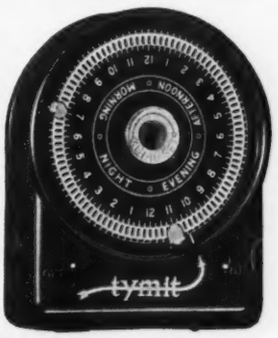
INDUSTRIAL and HOME VENTILATION



International Fans are silent . . . higher cfm of free air . . . particularly efficient against static resistance . . . a superior line of propeller fans in every respect.

Go after business with International. Full information and prices will be forwarded on request. Write now.

INTERNATIONAL ENGINEERING INC., DAYTON, OHIO



$8.05 net

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GRAYBAR BUILDING
NEW YORK CITY

Please send me quantity prices and wiring diagrams for connecting TYMIT, your new popular time control for

- ☐ oil burners
- ☐ gas burners
- ☐ stokers
- ☐ ventilating fans

Name .....
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AN AUTOVENT PRODUCT

FURNACE BLOWERS

● Now is the season for the furnace blower business and your opportunity to cash in on these seasonable sales. Autovent Furnace Blowers are made in seven sizes with various capacities. Each unit is complete with cabinet, V belt drive, sheave safety guard, motor, double inlet blower wheel and filter if desired. They are substantially built with blower wheels carefully balanced for quiet operation. Many exclusive features make Autovent the most outstanding quality blower in the heating field. Write for specification and price sheet. ●

AUTOVENT FAN & BLOWER CO.
1825 N. Kostner Ave. *Chicago, Ill.*

The Humidifier that Satisfies is the Automatic Drip. Heat Controlled.

Made in Sizes for All Furnaces

—

New Low Prices

—

Also a Humidifier for Steam and Hot Water Plants

Send for Catalog

Automatic Humidifier Co., Cedar Falls, Ia.

Barber Gas Pressure Regulators

Increasing numbers of Gas Appliance Manufacturers, Gas Companies, Jobbers and Dealers have switched to Barber Regulators because of their exceedingly low pressure drop, compactness, bronze bodies, precision of operation and their 100% value for the price. Why not write today for "stock" samples, complete literature, prices and discounts on the entire Barber line of Burners and Regulators?

Made in ¼", ⅜", ½", ¾" 1", 1¼", 1½" and 2" sizes.

The Barber Gas Burner Co.
3702-4 Superior Avenue
CLEVELAND - - - - OHIO

Self-Aligning Self-Lubricating

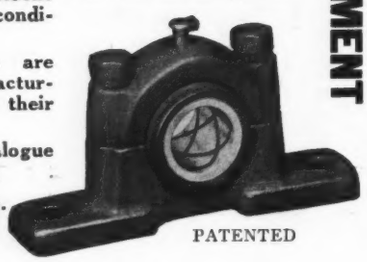
STANDARD EQUIPMENT

RANDALL PILLOW BLOCKS

Specify Randall Pillow Blocks on blowers, fans, air-conditioning units.

Randall Pilow Blocks are used by leading manufacturers, — a guarantee of their satisfaction.

Write for detailed catalogue and attractive prices.



PATENTED

Randall Graphite Prod. Corp.
609-613 West Lake Street
Chicago, Illinois

Trask Cost Saving Methods

(*Continued from page* 29)

are made in the form of a round bottom "T" with the bottom cut for the width of the opening from the furnace casing and the outer edge cut to the depth of the main duct. An arced bottom is then cut and seamed to the two Tees. The top, cut as a single piece, completes the chamber. The advantage is that the whole plenum may be cut and fabricated in the shop ready for connection to the mains which are seamed to the plenum.

The company has found it difficult to install new returns in the older houses, and for this reason oftentimes dispenses with second floor returns and takes air from the first floor. Generally these returns consist of one large return from the first floor hall and scattered returns from other rooms as conditions warrant.

Interesting, also, is the assertion made by the Trask engineers that floor type registers have been found satisfactory with the types of systems installed. Tests show the air floating up from the register to the ceiling where the warm air stream spreads out across the room to settle uniformly throughout the area. Few high side wall registers have been employed, for one reason because most installations are in old houses and side wall locations require expensive cutting.

By taking advantage of the economies provided by the described practices of combining round and rectangular ducts, using existing floor registers, register boxes and existing returns or returns from first floors only, the home owners have been saved the inconvenience and expense of cutting and fitting and much of the more expensive fabrication has been eliminated. At the same time all of the advantages of forced circulation, cleaning, automatic heat under automatic control, more usable basement space is assured.

Temperature and Humidity

(*Continued from page* 50)

humidity. We will lower this cubic foot of air to 70 degrees F. by extracting heat units from the air. This lowering of the temperature of the air 15 degrees F. squeezes the sponge-like ability of the air to hold moisture so it simply drops out in the form of solid drops of water and trickles down the drain pipe.

Let us say that our living room on a July day has a temperature of 90 degrees F. and a dew point or saturation of 70 degrees. The air contains 8 grains of moisture per cubic foot. Say we want a temperature of 65 degrees and a relative humidity of 50 per cent. The indoor air will then contain 3.4 grains of moisture per cubic foot. Our de-humidifier-cooler is now compelled to condense out 4.6 of the 8 grains of moisture contained in each cubic foot of air passing through the unit. This must be multiplied by the cubical content of the room or space to be cooled and de-humidified.

TO MAKE SELLING EASIER

Equip WITH G-E MOTORS

WHEN you present your next installation proposition, tell the prospect that you would like to use G-E electric equipment—motors, control, cable, etc. You won't have to sell him on their desirability. He's already convinced that G-E products are *high-quality* products. *The reputation of G-E equipment will help you sell.*

For example, General Electric offers you . . .

CARE-FREE-MOTORS . . . EASY TO INSTALL . . . SIMPLE TO MAINTAIN . . . DEPENDABLE

Type KH resistance, split-phase motors for belt-driven fans and blowers requiring up to ¼ hp; Type KC motors for the same class of service where the horsepower required is from ⅓ hp up (in the fractional-hp range). Both types have the following advantages:

LARGE OIL SUPPLY — Minimizes lubrication attention—once-a-season oiling is all that's needed.

BELT TIGHTENER (optional)—This new, radically different belt tightener depends on torque, and not on springs, for its action. It eliminates service calls for belt tightening or premature belt replacement—saves you money on that feature alone.

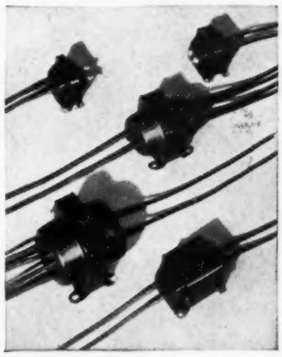
CUSHIONED POWER—Helps your installation set an agreeably new standard of quietness. Durable, springy rubber mounting, securely clamped in place, isolates vibration—eliminates unnecessary noise.

You can get G-E motors—small and large—in every type and size for every air-conditioning need. Our motor specialists—in a G-E office conveniently near you—will gladly help you choose. General Electric, Dept. 6A-201, Schenectady, New York.

070-107

OTHER AIDS TO SALES

G-E CONTROL TRANSFORMERS



Choose G-E control transformers for safety, convenience, and simplicity of wiring wherever small solenoids, relays, motors, lamps, and similar accessories needed for an air-conditioning installation must be operated at various voltages—stepped down from the lighting circuit.

General Electric's complete line of small control transformers makes operation at reduced voltages as simple as a, b, c.

There are standard G-E control transformers for many applications; your requirements for special voltages can be economically and quickly met from an extensive line of standard parts. Why not ask us for information on these control transformers?

MOTOR-STARTING SWITCH

General Electric's small motor-starting switch meets the demand for positive protection for fractional-horsepower motors.

Housed in a strong, steel case with an attractive aluminum face plate, it is easily installed—convenient conduit knock-outs are located in both top and bottom. It is equipped with unusually large, pure-silver contacts—an assurance of long life and trouble-free service. It has snap action, which prevents slow opening or closing, and also prevents burning of contacts.

Write for complete details.

GENERAL ELECTRIC

SELL Zone HEATING for present installations

ZONE heating is not limited to new installations. It can be installed in existing warm air or forced air plants just as readily.

Zoning a forced air system eliminates those heating difficulties that result from critical wind velocities and from certain types of exposure. The zoned system assures perfect circulation and desired temperatures in each part of the building all the time regardless of weather conditions.

Practically every home owner will admit that a uniform temperature throughout his entire home all the time is neither necessary nor desirable—also that it takes more heat and more fuel than necessary.

Zone heating gives the owner just what he desires and also permits him to save on his fuel costs. But Zone heating is essentially a matter of proper heating plant control. Only good controls assure satisfaction.

The key to satisfactory zone control is the "Genuine Detroit" Duct Damper Motor No. 431, which also controls fuel and air supply.

This unit may be mounted directly on the duct itself. It is noiseless in operation and makes a good appearance in place.

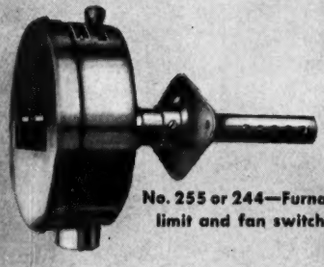
The new mounting makes installation easy and rapid because the shaft hole is accurately located—no measurements.

For more detailed information, write for Bulletin 66.

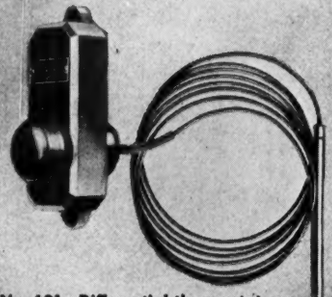
No. 431—Duct damper motor showing standard mounting.

No. 444 Thermostat

No. 443 or 445—Thermostat for night and day or heating and cooling.



No. 255 or 244—Furnace limit and fan switch.



No. 691—Differential thermostat operates on the difference between outdoor and indoor temperatures for summer cooling.

DETROIT LUBRICATOR COMPANY

DETROIT, MICHIGAN, U. S. A. NEW YORK, N. Y.—40 West 40th St.

CHICAGO, ILL.—816 S. Michigan Ave. • LOS ANGELES, CALIF.—3251 Wilshire Blvd.

Canadian Representative—RAILWAY AND ENGINEERING SPECIALTIES LIMITED, Montreal, Toronto, Winnipeg

DIVISION OF AMERICAN RADIATOR & STANDARD SANITARY CORPORATION

TRADE MARK REG. U.S. PAT. OFF.

Associate—Organize—Cooperate!

By W. A. Conkling
Secretary, Tulsa, Oklahoma, Assn.

MY dictionary defines these words as follows: Associate, to unite in company or ACTION. Organize, to arrange a task in SUITABLE parts, that it may be performed efficiently. Co-operate, to work or ACT together.

Therefore it is not only desirable that sheet metal contractors form associations, but that they organize the information available through their associations and co-operate by working together to apply such information to practical purposes.

I believe the most essential thing in the making of a strong organization is full and regular attendance at meeting. Here, by the personal contact, is created a friendly feeling which is soon followed by one of respect and confidence, and we are quickly shown that our competitor is a much better fellow than we had supposed and that the bad things we may have heard or thought of him, were either entirely wrong or exaggerated. Once acquainted, it is time to try out ideas that may prove practical and of mutual benefit.

Bad Accounts

There is the ever present bad account. What can be done to eliminate it and how can we speed up our collections? The following method has been used by the contractors of the Tulsa, Oklahoma association. Each firm prepares a list of accounts that are ninety days old or more, and turns it over to the secretary who arranges the names alphabetically in one complete list, giving each member firm a copy. Nothing appears on this list but the customer's name, but that name by appearing on the list means that person or firm owes some member shop a past due account. On the strength of this listing further credit may be extended or not as desired. Also, any member may ask for further information in open meeting concerning any name on this list. If there appears after a name the figure (2) or (3) in parenthesis, it means that name has been listed by two or three different shops. We are often surprised to see these (2's) or (3's) after the name of some person we supposed was our exclusive customer.

Thus we have found there are possibilities in credit information available without cost and in addition, by taking out a membership in the local credit organization, further information along this line may be secured at a small cost. This also speeds up collections by billing a job or sale as soon as completed instead of waiting until the end of the month.

Borrowed Merchandise

We have also had some interesting experiences in the matter of merchandise borrowed or bought and sold between member shops. This practice can become a nuisance unless properly handled. Our local organization has adopted this method. If merchandise is borrowed it is with the distinct understanding that it be returned PROMPTLY. If purchased from a competitor, the seller adds 25 per cent to his cost to pay him for this accommodation. This tends to make purchasers more careful in keeping stocks complete or if some member has to have some material quickly on a job he may have outfigured others on, this 25 per cent is at least some recompense for the loss of that job. Competitors who unfortunately do not have a credit rating, are asked to pay cash, as he would pay cash to his jobber if he bought of him.

Believing that it pays to advertise, especially when it costs nothing, each member of our association made a list of material they would like to dispose of. This list, consisting of slow sale or overstocked items, was turned over to the secretary who arranged them on one list (no prices shown) showing the merchandise under the firm who offered it. Anyone interested, simply calls that shop and bargains for what he wants. Tools were included in this list and prices and terms are a matter entirely between buyer and seller.

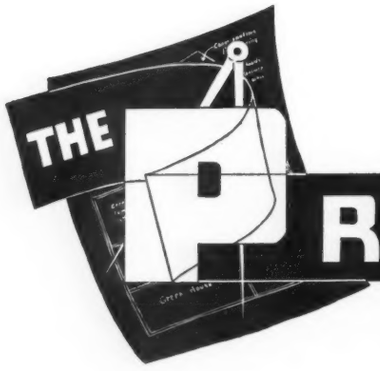
And last but far from least, what answer can association members give to this question? Have you divorced your local jobber and if so are you paying alimony in the form of lost profits on merchandise he may be selling direct to your customer?

You may say he started this practice and he might reply that you forced him to in order to secure a certain necessary volume of business to make up for your lost purchases.

Out-of-Town Buying

Now who is really to blame for this condition? The question is similar to that of which came first—the chicken or the egg, but of vastly more importance to sheet metal contractors. The firms of our city are working now on a solution. They first took the attitude that both parties were at fault and that under the new deal today is a logical time to do something about it. A list was prepared showing the amount of merchandise local sheet metal shops had purchased out of town during 1933. This was done in the following manner. Each shop furnished the secretary with the number of pounds of galvanized and black iron, the number of feet of

(*Continued on page* 60)



Gravity Filters

American Artisan:

A year or so ago there seemed to be considerable discussion going on relative to the practicability of installing air filters on a gravity furnace. We never installed such a job, but now a customer has asked for full information and for details as to how much trouble such as alteration may cause. Probably you have information on the experiences of other contractors or results of tests with such a set up. We will appreciate all information you can give us.

A. W., Iowa.

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Reply by The Editors

In October, 1932, Professor F. B. Rowley, Mechanical Engineer, University of Minnesota, submitted a report to the Owens-Illinois Glass Company covering tests made at the university on filters in gravity furnaces. The tests were made to determine the operating characteristics of a gravity furnace using Dustop filters in the return air pipe and to compare the results with those obtained for the same furnace without filters. The report said:

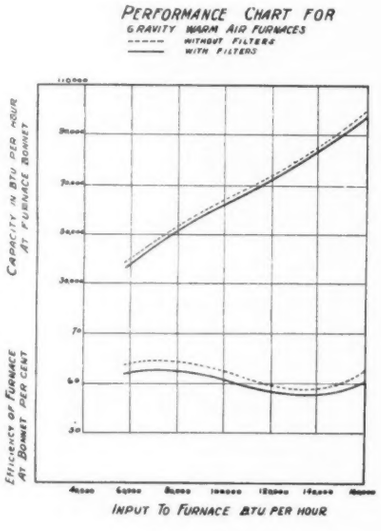
"For the purpose of making the tests, a steel furnace with a crescent radiator was selected. The furnace was set up under a skeleton or framework in the open laboratory, representing a house of two floors. Each floor was 12 feet square, with 8 feet between floor levels. Four 12-inch leader pipes were taken off from the bonnet for the first floor, and four 9-inch leader pipes were taken off for the second floor. Standard single walled leaders and risers were used, with baseboard registers for all outlets. The inlet air was carried to the furnace by three 18-inch diameter return pipes equally spaced around the furnace. Three filter boxes were provided, each of which was equipped with 16 by 25-inch standard Dustop filters. The filter boxes were removable from the inlet pipe, and when removed, equivalent lengths of open 18-inch circular pipe were substituted.

The furnace was rated as 2.9 square feet area, 60 square feet total heating surface, 52 inches diameter casing, and 725 square inches of leader pipe area.

Heat was supplied to the furnace by a conversion gas burner, using city gas of approximately 550 B. t. u. per cubic foot.

The necessary instruments were provided for determining the total heat input to the furnace, the total air passing through, the temperature rise in the furnace, and the stack gas losses. From these data, the performance characteristics were determined.

A series of tests were run both with and without the filters in the return


PERFORMANCE CHART FOR
GRAVITY WARM AIR FURNACES
WITHOUT FILTERS
WITH FILTERS
CAPACITY IN BTU PER HOUR AT FURNACE BONNET
EFFICIENCY OF FURNACE AT BONNET PER CENT
INPUT TO FURNACE BTU PER HOUR

pipe for the capacities ranging from 60,000 B. t. u. to 160,000 B. t. u. input to the furnace. The results of these tests are shown in the accompanying curve sheet.

From an analysis of the test results, it is evident that the installation of filters only neglibily reduces the volume of air passing through the furnace and gives a corresponding increase in the temperature rise of the air. The combination of the small decrease in volume of air and increase in temperature rise through the furnace when the filters are used gives a capacity at the bonnet slightly less than when the filters are not used, and, also, a slightly lower over-all efficiency at the bonnet. For the range of tests made, the average drop in efficiency was slightly less than 2%. The average rise in air temperature at the register face when using the filters was approximately 8°.

The stack gas losses remained the same for tests with and without the filters. It is therefore evident that the difference in efficiency was due to additional losses from the furnace jacket due to the higher temperatures when using the filters. In an average furnace installation, these losses from the furnace jacket would be used in heating up the basement.

◆

Gas Condensation

American Artisan:

I have a gas conversion burner installed in a coal burning furnace. The products of combustion do not get away hot enough or something for moisture gathers inside the flue and has come through the chimney and the plaster. I understand they line such flues in Chicago.

On account of the construction it is impossible to insert a tile lining. Aren't flues sometimes lined with metal. If so what kind of metal is used? We do not have this trouble with special gas furnaces—only with conversion burners.

F. E., Illinois.

◆

The subject of condensation of moisture in flues forms the basis for a two-part article; the first part appearing in the December, 1934, issue of AMERICAN ARTISAN and the second part tentatively scheduled for an early issue. Tear sheets of the December article and advance proof sheets of the second article are attached.

To the best of our knowledge, condensation of moisture is due to flue gas temperatures below the dew point of the flue mixture. However, under the conditions outlined in your letter there does not seem to be anything you can do because we presume you are operating the burner under full pressure and probably cannot take off any sections of the furnace, which would tend to increase the flue gas temperature.

We believe this situation is ordinarily remedied by either lining the flue with vitreous tile (which you say you cannot do) or putting a stainless steel sectional pipe inside the flue. This can be pushed down from the top and connected into the furnace pipe. It should be insulated, if possible. If not, the flue not occupied by the round pipe should be blocked off at the top so that there will not be a circulation of air up the flue alongside the pipe.

We can mention several contractors who have handled this sort of problem; you may want to communicate with them.

The Problem Corner . . . . . .

Gravity Velocity

American Artisan:

I have been using your charts for sizing main and branch pipes to equal friction per foot of length and have had excellent results. In comparing the results obtained with these charts in forced air systems with pipe sizes obtained by the Standard Code for gravity I notice that in the Standard Code no mention is made of C. F. M.

I would like to have you explain how to determine the C. F. M. in a gravity installation.

B. B., Indiana.

◆

Reply by The Editors

There is no definite way to establish C.F.M. in gravity systems, as the C.F.M. for each register will be changing continually as air temperatures rise or fall.

The flow of air in a gravity type system is dependent upon temperature. As air temperatures increase air volumes also increase and in a gravity system this results in the heated air becoming lighter and, consequently, this "hot air" is pushed through the leader pipes by the heavier cold air at the bottom of the furnace casing. Strictly speaking, hot air does not rise so the hot air does not flow simply because it is heated but because being lighter it is displaced below by heavier air, which is colder.

You will see from this short explanation, therefore, that if the air issuing from a register in a gravity system is 140 degrees we will have a certain velocity and, hence, a certain C.F.M. As the air from the same register increases to 195 degrees we will have a higher velocity, consequently, a greater C.F.M.

All gravity systems figured according to the Standard Code are based upon the arbitrary assumption that the register air temperature is 175 degrees. This means that when you design a system according to the Standard Code you assume a 175-degree register air temperature; consequently, a certain C.F.M. Whenever your gravity plant is operating at a combustion rate not sufficient to supply 175-degree register air temperature you will secure a lesser C.F.M. from the register.

The Engineering Experiment Station, University of Illinois, Urbana, Illinois, has isuesd a Bulletin No. 112, which states on page 37: at an average register temperature of 140 degrees approximately the velocty in the leader pipe to the first floor was 118 feet per minute; to the second floor 215 feet per minute and to the third floor 264 feet per minute. While at a register temperature of approximately 175 degrees the velocities to the first, second and third floors are: 148, 245 and 304 feet per minute.

Velocity in feet per minute is practically not considered in using the Standard Code to design gravity installations but velocity and temperature are calculated on the basis of the Btu's per square inch of leader pipe for first, second and third floor registers based on the aforementioned 175-degree register air temperature. These assumed Btu capacities per square inch of leader pipe give us the factors 9, 6 and 5, used in the Code to determine leader piper diameter.

◆

Duct Work Costs

American Artisan:

Would you kindly tell me if there is a book or magazine printed in which there might be instructions on how to figure ductwork, blowpipe work, etc., by the pound?

I have been reading your magazine the "American Artisan," for the past ten or twelve years, but have never noticed any articles of this kind. I have read plenty on how to estimate materials but I find where the difficulty lies is in figuring labor, both for erecting and fabricating.

I find that most contractors are figuring on the pound basis, especially duct work, but I don't seem to be able to work out a method and feel safe.

Some contractors figure skylights by the square foot, roofs by the square, gutters by the foot, furnaces by the run, etc. I figure most of my labor by my own experience which is too long and drawn out a method.

I have been with the H. E. Hessler Co. for nearly twenty years, in the sheet metal department which my brother and I bought out recently. Our business runs mostly to ventilating, blowpipe work, general sheet metal work and air conditioning.

H. H. H., New York.

◆

Reply by The Editors

So far as we know, there is no book which provides a method for calculating the labor cost per pound on duct work for blow pipe and ventilation.

There are a number of books (and we have published several articles) covering the method of taking off weights and quantities of materials required, but generally all such schemes leave the matter of figuring labor up to the contractor. The reason, of course, is that labor will vary according to the locality; the skill of the mechanic and layout man and the speed with which the mechanic fabricates and installs. Most contractors keep a record of typical jobs and compare the actual labor required with new work for the purpose of ascertaining approximately how much the labor will amount to.

If you would like to write two or three individuals, who may be able to offer some advice, we shall be glad to furnish names and addresses although we do not know just what information you will get.

If you will supply a typical job on which you bid together with plan of the job and the quantities of materials you figure, we shall be glad to publish the plan and estimate in our "Problem Corner." Any interested readers will then tell you just what they would bid in for labor. This might result in your obtaining some interesting price figures.

◆

Elbow Radius

American Artisan:

Referring to your article in the March issue, what radius do you recommend for the throat radius of the sweep elbows on ordinary jobs where the work is not special? We wish to build these sweep elbows with as little resistance as possible.

H. A., New York.

◆

Reply by The Editors

We recommend that the radius of the elbow be 150 per cent of the duct width. This gives an elbow which flows practically full under the velocities now favored by the industry. Any increase you can add will be an advantage, but any shorter radius may result in trouble.

◆

Painting Hood

American Artisan:

I have a customer who wants me to build a hood for air brush painting of automobiles. He saw something of the kind at the Chicago Fair. Can you give me the dimensions, construction, size and shape of the hood, size of exhaust pipe and fan required?

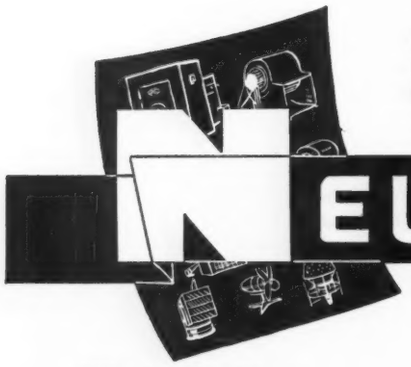
F. S., Illinois.

◆

Reply by The Editors

It is difficult to give an answer to your query without knowing how many operators, how many cars are to be painted and whether the chamber is to occupy floor space inside a building or be built outdoors. We will ask some authority to send you suggestions.

Has any reader built such a hood or booth and if so will he please send sketches and full information?



For your convenience a number has been assigned each item. Check the items in which you are interested on the coupon on page 69 and mail to us. Complete information will be forwarded.

● Indicates product not listed in 1935 Directory

△ Indicates product and manufacturer not listed in 1935 Directory

NEW PRODUCTS

200—Air Conditioner

The new Sunbeam Oil Burning Air Conditioning Unit manufactured by The Fox Furnace Co., Elyria, Ohio, a division of American Radiator & Standard Sanitary Corporation, stresses attractive appearance. The finish is smooth, glossy green enamel baked on a cabinet of heavy, cold-rolled, furniture stock. Chromium plated trimming strips contrast pleasingly with the colored surfaces. All corners are rounded. All bolts and screws are concealed.

"Believing that efficiency is taken for granted in Air Conditioning Units produced by well known manufacturers," stated C. A. Olsen, president of Fox Furnace, "we have made a special effort to help establish new and higher standards in attractiveness and beauty."

The new Sunbeam product is designed for oil burning exclusively. In one model the oil burner connects to the front of the heating element, where it is concealed by the door of the cabinet. In a second model, the oil burner connects to the rear of the heating element.

◆

201—Blower

Lau Heating Service, Inc., Dayton, Ohio, announces the new 500 Series blower, a true centrifugal wheel, mounted on rubber, housed in a 29-inch cabinet, equipped with filters, motor, switch. No canvas connections are required.

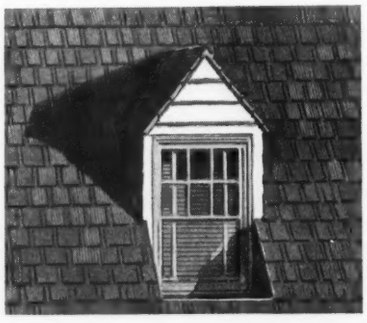
The new unit will be manufactured in six sizes from 1050 to 2800 c.f.m. Each size is especially adapted for a standard size of furnace from 22-inch to 34-inch firepot, and a gravity pipe rating from 525 to 1500 square inches of leader pipe area.

Full information is presented in a leaflet the company will mail.

202—Copper Shingles

The New Haven Copper Company, Seymour, Connecticut, announces a line of Kenmar copper shingles which may be obtained in bright copper, patinated, lead coated or oxidized finish colors as desired.

The shingles are made of pure sheet copper, gauges No. 30 and 32. Each



shingle is rectangular in shape—16 inches long and is furnished in three widths—8, 10 and 12 inches. The shingles are ribbed up and down or corrugated. Each shingle has a rolled lower edge, the height of which can be varied to conform to the architectural effect desired. The shingles are laid in the same manner as wood shingles. The company recommends that the shingles be laid with 1½ to 4-inch gaps between shingles. Each shingle is held down with copper nails, driven about one inch in from either side of the shingle and about ten inches up from the lower edge. The company recommends the shingles to be laid about 6 inches to the weather with at least a 3-inch side lap and 4-inch head lap. If necessary the standard shingle can be bent for use on hips or ridges. Full information on the new product has been prepared in literature form available to contractors.

◆

203—Conditioner

The L. J. Mueller Furnace Company, Milwaukee, Wis., will have available for the market in the very near future, a new self-contained, oil-burning, air conditioning unit, for all types of residential heating and air conditioning.

This unit will consist of burner, furnace, blower, filters, and automatic humidifier, housed in an attractive casing.

● 204—Paint Primer

American Chemical Paint Company, Ambler, Pa., announce Lithoform, a primer to make galvanized surfaces "take" paint. The coating is claimed to not wash off, will not chip, will not corrode in the weather, and it is not affected by baking temperatures.

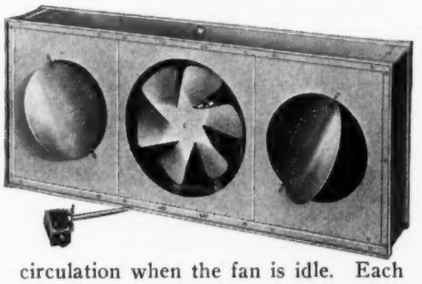
Lithoform is applied by brushing it on, or by spraying. The surface is first cleaned and then lightly scoured with fine steel wool. Following the Lithorizing treatment, the surface is washed and dried and is ready for painting.

The manufacturer states the reason paint will not adhere to galvanized iron and galvanneal is because the zinc oxides and carbonates formed on the surface by reaction with the atmosphere, combined with the oil in paint to form an insoluble, inelastic zinc soap.

◆

205—Furnace Booster

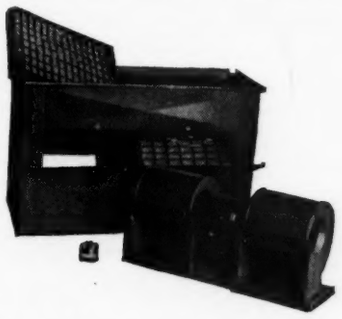
Russell Electric Company, 342 West Huron Street, Chicago, Illinois, announce a new air conditioning booster. The unit consists of a steel cabinet 50 by 21 by 9½ inches framed with angle iron on both sides for easy connection to the furnace boot. A 1/12 horse power motor, cushioned in rubber, is directly connected to a 14-inch fan of a new type. The fan has a large area at the tips of the blades. One thousand square inches of filters are supplied as standard equipment together with a line voltage fan switch. Two large by-passes insure gravity



circulation when the fan is idle. Each of these by-passes is 12-inches in diameter. At 1450 r.p.m. the fan is said to deliver 1400 c.f.m. at .04 inches and 1040 at .12 inches. At 1000 r.p.m. the fan is said to deliver 800 c.f.m. at 0.4 inches. The unit comes equipped with a 100-speed control so that delivery may be matched to the requirements of the job.

206—Package Blower

A new direct-driven furnace blower, known as the No. 14 package unit, is announced by the Emerson Electric Manufacturing Company, 2014 Washington Avenue, St. Louis, Missouri. The blower consists of twin wheels mounted on extensions of the motor shaft and the motor mounted on re-



silient rubber cushions. The motor is 1/10 horse-power, single phase, operating at 1140 R.P.M. Two filter sections are used and the air delivery with filters in place is 1,100 to 875 C.F.M. The unit comes housed in a complete cabinet ready for installation. A two-speed, snap switch provides two-speed operation by turning the switch. The blower may be connected to a bonnet control for automatic operation.

◆

207—Air Filter

A new filter, of the throw-away type and known as the Plymco, is announced by the Plymouth Cordage Company, North Plymouth, Massachusetts. The filtering medium is composed of clean, strong, flexible rope fibers, light in weight, odorless, non-corrosive and free from all splinters. The fibers possess toughness, flexibility and durability. The fibers are treated with a highly efficient, viscous, semi-solid adhesive to increase the natural dust-holding capacity of the fibers. The fibers are arranged in graduated layers, the intake layer being rendered fire resistant. From the intake side each successive layer is finer than the one preceding it. The fibers on the exhaust side are most closely packed to resist passage of the finer particles; such as, pollen and dust. The filters have a capacity of 800 cubic feet per minute at a velocity of 300 feet per minute and vary in resistance from .08 to .25 water gauge. The filters will be made in all standard sizes.

◆

208—Humidifier

Maid-O'-Mist, Inc., 43 East Ohio Street, Chicago, Illinois, announce the 85-H humidifying unit. The humidifier consists of a fine gray iron, enameled pan of such a size as to be adequate to give off sufficient humidification during moderate weather. A patented overflow or support pipe can be raised in extreme cold weather thus reducing the capacity of the humidifier. The unit is fed by an automatic float operated feed valve which is enclosed in a self-contained unit. The feed valve is equipped with a self-closing core, which permits the carrying of a thin sheet of water in the pan. A large corrosion resisting screen, containing nearly three square inches of area, prevents the entrance of material particles.

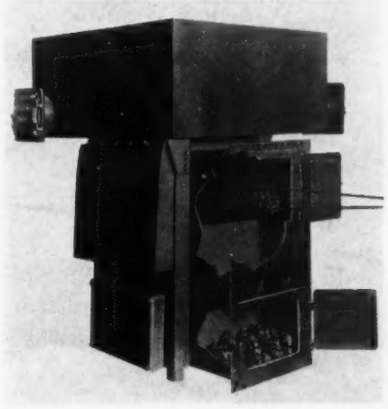
◆

● 209—Stoker Furnace

Premier Furnace Co., Dowagiac, Michigan, announces a new line of furnaces, principally designed for installation with any make of stoker.

Stoker connection can be made through special ports provided at either the right or left side and the unit is equipped with a clinker disposal chute whereby hot clinkers are dropped to a receptacle within the furnace where they are allowed to cool before removing to be disposed of as ordinary ashes.

Side stoker connection gives free ac-



cess to the furnace front and permits a new degree of simplified operation. The furnace is built in connection with a blower and air filtering system and is shipped complete with furnace, square casing, blower, filters, automatic humidifier and automatic fan control. The stoker may be selected from the wide variety of stokers offered by manufacturers.

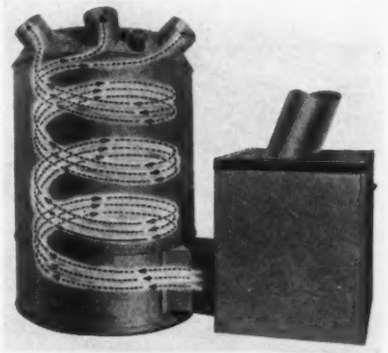
◆

210—Humidifier

Rochester Manufacturing Company, Rochester, New York, announce "Healthaire," a new humidifying device designed for incorporation in the smoke pipe between furnace and chimney. The humidifier consists of a housing through which the smoke pipe is extended. Inside the unit there are multiple copper tubes totally confining the water and possessing a heating surface of more than 800 square inches. Heat from the smoke pipe vaporizes the water in the tubes. The tubes are then carried into the bonnet of the furnace where the water vapor is ejected into the warm air stream. Photographs of the new device with explanation of its installation and operation are contained in literature which the company will mail.

211—Blower

Swirling air is a new principle of air delivery, that has been developed by the Viking Air Conditioning Corp., Cleveland, Ohio, for converting ordinary furnaces into air conditioning systems, without baffling. The VIK-AIR conditioner, which employs this departure from conventional furnace

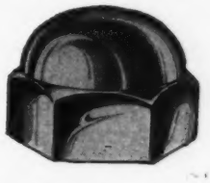


blower practice, introduces the air into the furnace at an angle that imparts a swirling motion to the air. Its sponsors claim it sweeps the heat from all parts of the furnace, and delivers it uniformly to every pipe. Baffling of the furnace is made unnecessary, as interference and dead air pockets are prevented by the swirling air. Literature is available upon request.

◆

● 212—Cap Nuts

Parker - Kalon Corporation, 200 Varick Street, New York City, announce a new product known as the Parker-Kalon cold-forged cap nuts. The cap nuts are die-formed and of uniform shape and are cold-forged to produce a much stronger nut. Each nut is exactly the same size as every



other one and the nuts are free from tool marks or imperfections. The nuts are true to size within close limits and all holes are countersunk before tapping. The nuts fit bolts of all sizes.

◆

● 213—Tank Heater

The Evins F. Glore Sales Corporation, Grand Central Terminal Building, New York City, announce the Glore oil burning tank heater for range oil burner. The heater consists of a cast iron water section, a heavy sheet iron body and dome covered on the inside with heavy porcelain. The heater is also porcelained over the entire outside with the porcelain fused to the cast iron under a temperature of 1,600 degrees. The heater is designed in three sizes ranging from 30 to 150 gallons of water through a 100 degree temperature rise in four hours.

Itemized Debts of Code Authorities

AS the appeal for funds to reimburse code executives, as published in AMERICAN ARTISAN, resulted in several letters questioning the total sum of $60,000, which was given as the amount needed, it seems desirable to now publish a detailed statement of the items making up that amount. One member of the industry in his letter frankly stated that it appeared to him as if someone wished to make money through this appealing for funds.

Details of the obligations of the National Code Authority and the amount due to individuals for their out-of-pocket expenses are presented in an accompanying tabulation. In the same table is given an estimate of the amount required to reimburse members of local and regional code authorities for their out-of-pocket expenses. This must necessarily be an estimated amount, as details are not available.

That the industry may be fully advised on the obligations so far as salaries are concerned, a second tabulation is presented showing approximately $40,000 of accrued salaries to members of the National Code Authority.

The original appeal resulted in some contributions, but only a fraction of the amount needed to reimburse the different individuals for their out-of-pocket expenses. Checks should be drawn to the order of Joseph C. Gardner, Trustee, and marked "Code Expense Trust Fund." Such checks should be mailed to the editor of this journal, who will see to it that they are forwarded promptly to Mr. Gardner.

Money collected will be treated as a trust fund and cannot be used for any other purpose than that for which it is collected.

Summary of Expenses of members of Code Authority unpaid May 27, 1935, at termination of Codes.

Travel and Office expenses including stationery, postage, telephone, telegraph and clerical salaries:		
J. Boyd Griffiths	$ 911.72	
W. S. Hays	1,006.53	
W. C. Markle	1,602.04	
Chas. A. Earley	85.73	
Geo. Brown	88.88	
W. Roy Eichberg	357.96	
W. P. Budd	559.95	
O. A. Wendt	470.67	
H. Stanyer	4,261.62	
D. A. Jackson	2,589.70	
G. M. Olson	170.19	
		$12,104.99
Code Authority Bills Payable:		
Printing	247.80	
Reporting of Code Election Proceedings	102.61	
Auditors	400.00	
Rent (Law & Finance Bldg.)	169.00	
Rent (Office and equipment—Natl. Assn. Sh. Met. Contrs., 12 mos. @ $50.00)	600.00	
Expense to liquidate corporation (Legal, accounting and State fees, clerk hire, postage, etc., estimated)	1,000.00	
		2,519.41
Pre Code expenses incurred by National Trade Associations, J. Boyd Griffiths, W. S. Hays, W. C. Markle and a few other individuals		18,805.73
		$33,430.13
Estimated amount required to reimburse members of Local and Regional Code Authority members for out-of-pocket expenses		26,500.00
Total		$59,930.13

In addition to bills payable and out-of-pocket expense of members of Code Authority the following accrued salaries and per diem remain unpaid:

J. Boyd Griffiths	$ 3,833.33
W. S. Hays	7,187.50
W. C. Markle	7,187.50
Chas. A. Earley	1,256.25
Geo. Brown	1,009.62
W. Roy Eichberg	3,462.50
W. P. Budd	4,100.00
O. A. Wendt	1,340.00
W. H. Miller	800.00
H. Stanyer	1,825.00
D. A. Jackson	5,562.00
G. M. Olson	375.00
Total	$37,938.70

Associate, Organize

(*Continued from page* 55)

conductors, gutters, etc., the number of pounds of copper, zinc, etc., they had purchased from out-of-town wholesalers during the year. The secretary totalled these items and reported this total to the association who will, through a regularly appointed committee, present it to the local jobbers. It is not known what any firm turned in on this list as totals only were prepared by the secretary and were made available to the association. We believe the amount of merchandise thus shown will prove of interest to our local jobbers and that they will co-operate with us in keeping this business at home where it surely belongs.

Health Center Building

(*Continued from page* 17)

ing, and electric pipes in the area affected are outlined on the drawing. Ducts are then outlined, after which each duct line is divided off into sections and slip joints are indicated, the sections of straight duct are kept 8 feet long where possible, thus eliminating unnecessary connections in the field and avoiding waste of material in fabrication. All sections are then numbered in consecutive order and the drawing titled with the particular floor, such as, basement, etc.

Each fitting is then detailed on a small white carbon copy detail book, on which is noted the number of the section, such as B-1, B-2, etc. The white sheets are removed from the book and sent to the shop for fabrication. Carbon copies are kept in the book for future reference.

The working drawing is kept on the job to be used by the mechanics installing the work.

Noted on each detail slip is the date, section number, gauge of material, kind of material, whether fitting is to be assembled in shop or left apart and type of slip connection. See sketches of construction.

Firms handling construction of the heating and ventilating work are:

Architect—Charles B. Meyers.

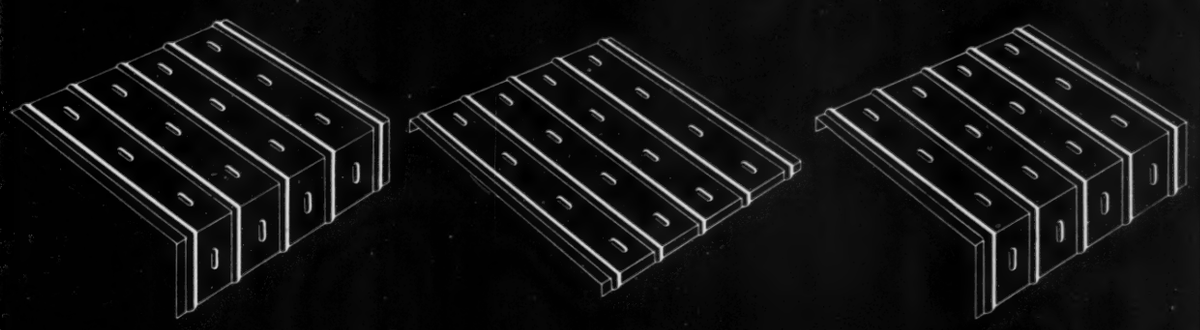
Engineers—Clark, MacMullen & Riley.

General Contractors — Cauldwell Wingate Co.

Heating Contractors — Jarcho Bros., Inc.

Ventilating Installation—Charles Hartmann Co.

You can cut, bend and form
REVERE
THRU-WALL FLASHING*



One special advantage of Revere's new Thru-Wall Flashing is that it is always furnished in *flat sheets* . . . and the sheet metal contractor can cut, form and bend it to any shape he wishes, in his own shop with his every-day equipment. This eliminates the special ordering of several types of flashing which are, as a rule, necessary to meet ordinary flashing requirements. And so, time is saved and delays eliminated.

Revere Flashing is available in standard widths from 8 to 36 inches inclusive. The over-all length is 74 inches . . . when laid up with two-inch overlap, this measures 72 inches. The sheets nest tightly (25 to one inch) . . . so this flashing is easy to handle, store, and transport to the job. This flashing is made of Revere copper (soft temper) or non-staining Revere Leadtex (lead-coated sheet copper). It is designed with parallel rolled ribs at three-inch intervals across the full width of the flashing. Between the ribs are embossings. These ribs and embossings make an unusually tight bond between mortar and flashing, prevent all lateral movement of the wall, take care of expansion and contraction, and allow water to drain off quickly.

Revere flashing is so designed that you get a water-tight interlocking joint with two-inch overlap, and form a continuous flashing *without the use of solder*.

Revere distributors carry Revere Thru-Wall Flashing in stock. They can also supply the well-known Cheney Flashing, now reduced in price. These two flashings answer your needs for any and all types of construction. Write for full details.

* *Patent No. 1,928,589*

Revere Copper *and* Brass

INCORPORATED

Founded by Paul Revere 1801

EXECUTIVE OFFICES: 230 PARK AVENUE, NEW YORK CITY · MILLS: BALTIMORE, MD. · TAUNTON, MASS.
NEW BEDFORD, MASS. · ROME, N. Y. · DETROIT, MICH. · CHICAGO, ILL. · SALES OFFICES IN PRINCIPAL CITIES

News Items . . . . . .

Welding Conference

Purdue University, Lafayette, Indiana, announces that the Eleventh Annual Conference on Welding will be held at Purdue University, Thursday and Friday, December 5 and 6. Full information on the conference may be obtained by writing J. D. Hoffman, Director, Department of Practical Mechanics, Purdue University.

◆

1936 to Usher in Modernism

Very few of the houses erected during the 20's will be put up during the building boom which should get started next year, Fortune Magazine predicts in its October issue.

The keynote of the new building boom will be modernism, featuring a completely new conception of the functions to which a building can be put. And houses in the new style will cost 30% less than a comparable house in the traditional style.

Fortune bases its forecast in part upon a detailed survey of opinion in all parts of the country and among all economic levels which indicates that over 40% of the people, although living in traditional houses, would prefer to have a completely different type of dwelling for themselves and their families.

Real modern architecture has yet to come, says Fortune. At present there are no more than fifty residences in the U. S. which show an honest acceptance of the so-called "functional motif," while throughout the whole country there are only two office buildings and less than a dozen theatres which can be called truly modern.

Along about the year 1936, Fortune claims, there will sprout in the U. S. a second building boom. It will probably be less of a boom than its predecessor. Its mother will be necessity, not the stock market. Its wage scales may be lower, its silk stockings skimpier, and its automobiles more battered than the wage scales, silk stockings and automobiles of the decade before. But its architecture, by and large, will entirely eclipse, cancel, repeal and nullify the architecture of the school of Coolidge. For the characteristic architecture of the boom of the thirties (and the forties) will be inventive, not imitative, rational, not faked. In other words, it will be Modern.

◆

House on Wheels

More Modern Homes in America Council, 11 West 42nd Street, New York City, sponsors of an educational building known as "The House on Wheels," announce that a typical house, fully equipped and representing the most modern practices in home construction and furnishings, will be mounted on a truck and routed throughout the United States. Several trucks are planned, each to cover a certain area of the country. The house shown will be of such size and contain such equipment that it can be erected in any community at a cost not to exceed $5,000. The exhibit shows full size interior of all rooms. The walls and ceilings are constructed in portable sections so that the house can be taken down and set up during transportation and for exhibit purposes. It is expected that the first twelve units will be ready to go on tour in November and others will be sent out as soon as possible. Contractors may obtain additional information on the exhibit and its routing by addressing the Council.

◆

Farmers Using More Metal

Memphis Fence and Roofing Co. headed by Julian Fullenwider reports that the farmers in his area are using more metal roofing now than for a long time. Many farm houses have been given new roofs of crimped galvanized steel roofing. The plant has been operating on a day and night shift during much of the 1935 season.

THE "BLENDED-IRON"
Patented diamond shaped radiator, specially designed water pan, patented rod construction, and many other features.

ROUND OAK STOVES

DISTRIBUTORS

Sioux Falls Corrugating Co., Sioux Falls, S. Dak.

Waterloo Metal and Mfg. Co., Waterloo, Iowa.

Haw Hardware Company, Ottumwa, Iowa.

The MacIntyre Company, Fond du Lac, Wis.

Wm. Dutton & Sons Co., Hastings, Neb.

Sam H. Kimbler, Denver, Colo.

New Finance Plan
Stimulates Sales Tremendously

"The greatest selling help we've ever had!" That is what dealers say about the new ROUND OAK finance plan.

And . . . this valuable finance plan is just one of the advantages enjoyed by ROUND OAK Dealers. The quality and completeness of the ROUND OAK line, the moderate prices offered, the valuable assistance of ROUND OAK sales, engineering and advertising departments . . . all these are yours when you take on this nationally known furnace line.

Write today for the ROUND OAK dealer proposition. Find out about the increased possibilities for sales and profits with this COMPLETE line of steel and cast iron furnaces for solid and liquid fuel. Learn how ROUND OAK helps you sell on time payments, without tying up your own capital.

THE "MOISTAIR BOILER-PLATE"
Seamless electric arcwelded unit construction, permanently tight and leak-proof. A modern, economical, dependable, heating system.

ROUND OAK COMPANY
STOVES . . RANGES . . FURNACES . . AIR CONDITIONING
DOWAGIAC SINCE 1871 MICHIGAN

BE A GOOD NEIGHBOR

It's the Best American Tradition

THERE was a time, not so long ago, when being a good neighbor was a real factor in getting America going—and keeping us on our way.

In that day a man and his sons might cut and hew the timbers for a new dwelling and frame them stoutly on the ground. But before the walls could be raised, before the roof could go on, these builders needed and received the help of their neighbors. It was given generously in the old Colonial "house raising."

The same necessity for being a good neighbor, for helping the other fellow whenever he needed help, was recognized in all departments of early American life. Days of labor and the use of teams were exchanged as conditions of the crops demanded. And in time of sickness, fire, drought, attack, each man was in truth his brother's keeper.

In spite of the specialization of modern times, the speed and the scope of business and social life, there is, more than ever, the need for the good old American virtue of being a neighbor. No longer are you called upon to help the other fellow frame and raise his house, or to fight shoulder to shoulder with him against a common foe. But it is your responsibility to support, as you are able, institutions that minister to his welfare and the welfare of his family as definitely as a pioneer ever helped his neighbors. Hospitals, clinics, day nurseries need and deserve your help. . . . So do homes for the aged, the blind, the incurable. . . . So do the agencies that build the youth of your community.

It's still necessary to be a good neighbor. And it's still possible. Support your Community Chest. Answer local welfare appeals. You will be the best possible neighbor in your own neighborhood!

Gerard Swope
Chairman,
National Citizens' Committee

All facilities for this advertisement furnished the committee without cost

MOBILIZATION FOR HUMAN NEEDS—1935

News Items . . . . . .

Chicago Air Conditioning Installations

A survey recently issued by Commonwealth Edison Company, in Chicago, for the first six months of 1935 shows 193 air conditioning installations completed.

This bring the total air conditioning installations in Chicago to 817. Distribution of installations by type are as follows: theaters, 136; private offices 135; restaurants, 133; general offices and buildings, 71; residences, 52; stores, 78; drug stores, 16; beauty shops, 10; banks, 8; hospitals, 9; bakeries, 19; candy shops, 28; printing plants, 23; miscellaneous, 25; undertakers, 17; studios, 4; dentists, 8; dance halls, 4; club houses, 4; churches, 3.

◆

Plan Indiana's 1936 Convention

The Sheet Metal, Warm Air Heating and Roofing Contractors' Association of Indiana, through the convention committee headed by O. A. Voorhees, announce that plans are already under way for a much larger and more interesting convention. The date of the convention will be January 21 to 23, held in Indianapolis. The convention committee is giving serious consideration to practical demonstrations in connection with the exhibit whereby sheet metal and heating contractors may secure first-hand information on new products, new apparatus and suitable methods for using this material. The convention committee hopes to be able to set up a program whereby practical demonstrations will be the key feature of the program.

◆

Contractor Gets Metal Roof Work

J. J. Holland, sheet metal contractor, has installed this autumn several metal roof jobs in Brownsville, Tenn., and has completed the spire work and vane on the Methodist church of the city.

Business Improves in South

This fall's business for the sheet metal and furnace firms of the Birmingham, Ala., district has witnessed an encouraging resumption of activity. Several firms specialize in this field. Ensley Sheet Metal Works, show the Williamson Warm Air furnaces at Ensley, Ala. Hawkins Roofing and Heating Co. in Birmingham have an inspection and estimating service for prospective builders. Heating Service Co., 2811 S. 7th Ave., have a good display floor in furnace work. Birmingham Furnace and Roofing Co. has enjoyed a good September in furnace installations.

◆

Contractor Wishes Catalog

Mr. A. D. Currens of the Air Distributing Corporation, 1923 Main Street, Kansas City, Missouri, writes that he would like to be placed on the mailing lists of manufacturers to receive all catalogs and literature pertaining to warm air heating and air conditioning equipment and prices.

◆

Contractor Handles Distillery Work

Gatewood-Sengel Copper and Brass Works, 632-634 Baxter Ave., Louisville, Ky., have completed copperwork installations for seven distilleries during 1935. One of the latest jobs assembled was for fabrication for the Dowling Bros. Distillery Co. at Burgin, Ky. R. J. Sengel heads the copper works.

◆

Does Furnace Cleaning

S. B. White, 414 S. Roan St., Johnson City, Tenn., has one of the best equipped sheet metal shops in upper east Tennessee. At the beginning of present season its super service vacuum machine was cleaning a good many furnaces in and around Johnson City. Roofing and general sheet metal work have been quite active in the latter part of 1935, several new industries coming to the city and building mills requiring blow pipe, smoke stack and similar outlays.

IT'S NEW.!
FROM TOP TO BOTTOM!

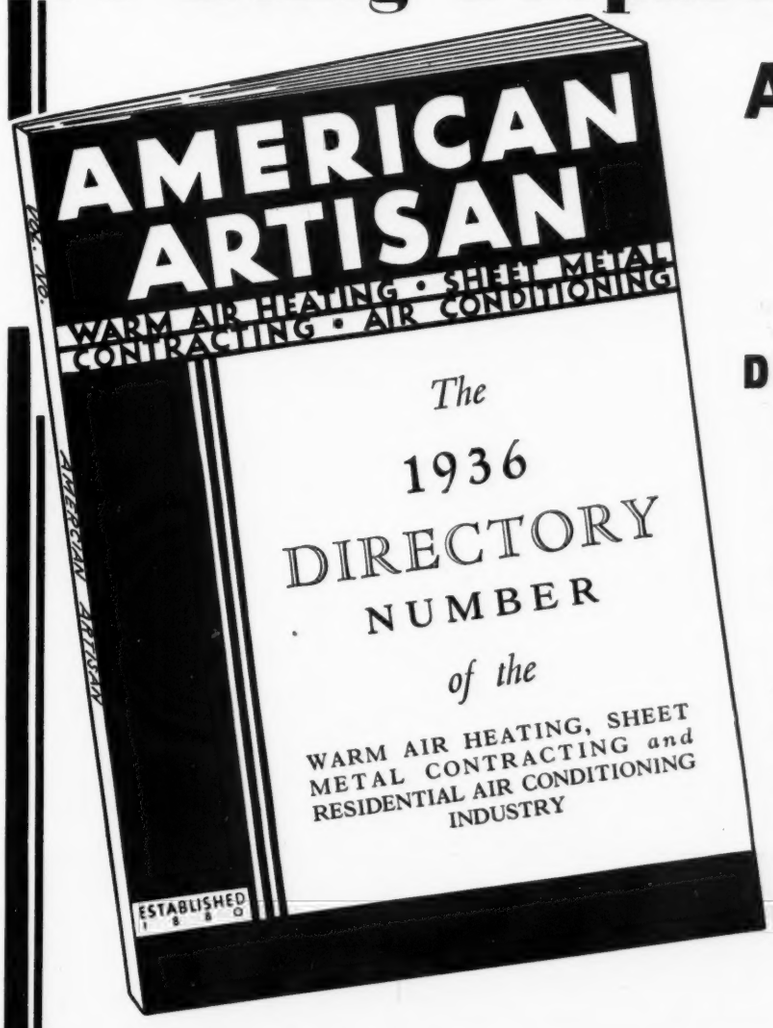
Check the features of the Wise "A" Series Furnace:

- New One-piece Self Cleaning Radiator
- Domestic Hot Water from New Water Jacket
- Slip-over Front and Surface Ground Feed Door
- Extra Heavy One-piece Wise Air Cell Fire Pot
- Provision in Humidifier for Automatic Float Valve
- Ash Pit and Lower Front Cast in One Piece
- F. H. A. Financing

The Wise Series "A" Furnace has built-in exclusive features that represent the greatest advancement in furnace construction recorded in recent years. They will convince your prospects that Wise Series "A" will save them time, labor and money. Wise dealers throughout the country are now cashing in on this great furnace.. Investigate its possibilities for your territory.

WISE FURNACE CO., AKRON, OHIO

It's Being Prepared ♦ ♦ ♦



AMERICAN ARTISAN 1936 DIRECTORY NUMBER

Listing close to 300 products, 1,000 trade names, 1,200 manufacturers' addresses . . . the most valuable buying service ever offered the industry . . . completely re-checked and brought up to date for 1936 use.

Also Featuring This Year

Special section "prevuing" the 4th International Heating, Ventilating and Air Conditioning Exposition to be held in Chicago January 27-31 . . . the same week in which the National Warm Air Heating and Air Conditioning Association will be holding its winter meeting in Chicago.

WHO MAKES IT? WHERE ARE THEY LOCATED?

Just look in AMERICAN ARTISAN'S Annual Directory Number, to be issued in January. There you will find listed every product used in warm air heating, sheet metal and residential air conditioning work. Under each product will be the name of every manufacturer who makes it. Also, all trade names will be listed, and complete address of every source of supply.

This Annual Directory Number of AMERICAN ARTISAN is an outstanding service to buyers and specifiers . . . an exceptional opportunity for manufacturers to place the complete story of their line before these buyers and specifiers. The 1936 issue is now being compiled, will be put in the mails shortly after the first of January.

This particular number will have added interest due to the special section covering the 4th International Heating, Ventilating and Air Conditioning Exposition at which many manufacturers in this field will exhibit.

Combined with the ARTISAN'S regular editorial content, these special features will make this January number the most talked of, most thoroughly used, most valuable service ever offered the industry.

This number will be given over 7.000 mail distribution to the real buying power of the industry—contractors, dealers, wholesalers and manufacturers. Additional copies will be distributed at the exposition.

AMERICAN ARTISAN • 6 N. MICHIGAN • CHICAGO

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 69.

303—Control Display Leaflets

The Mercoid Corporation, 4201 Belmont Avenue, Chicago, Illinois, announce two new contractor leaflets, each carrying a photograph of the typical Mercoid automatic control display board. One display board covers the controls suitable for oil burner operation; the other shows controls suitable for stoker operation. The various control instruments shown on the boards are explained in detail in the leaflets. Copies may be obtained from the company.

◆

304—Package Blower Leaflet

The Brundage Company, Kalamazoo, Michigan, announce a mailing leaflet covering the package knock-down blower. The leaflet shows a large illustration of the blower unit with side removed so that the blower, motor and filters can be readily seen. Text material covers the general design and construction of the unit and explains what can be done to secure winter and summer air circulation by means of the blower attached to an existing furnace. The leaflet is designed for mailing purposes to prospects.

◆

305—Control Apparatus Catalog

A condensed catalog, dated August, 1935, is announced by Automatic Products Company, 121 North Broadway, Milwaukee, Wisconsin. It shows illustrations of all of the company's thermostats, humidistats, valves, pressure regulators, transformers, relays, fan and combustion controls, together with a brief description of the apparatus and prices to the trade.

306—Tests of Furnace Metal

A leaflet describing the tests wherein the reactions of castings to temperature change and stress, plus deterioration of the metal, is announced by Mt. Vernon Furnace & M nufacturing Company, Mt. Vernon, Illinois. The test described consisted of subjecting six iron bars of identical size, but of different material, to approximately 1,500 degrees of heat for 497 hours and as a further test three of the bars were subjected to 1,171 hours at the same temperature. As the bars were withdrawn they showed increases in length and diameter, also increases in weight, showing the growth of the metal. The fact brought out in the leaflet is that Vernalloy was less subject to change due to the severe conditions than the other materials tested. This, the company declares, promotes longer life. Photographs of the bars taken during and after the tests are shown in the leaflet.

◆

307—Time Control Leaflet

A small leaflet, prepared by the Tork Clock Company, Mount Vernon, New York, shows illustrations of "tymit," the new timing device for automatic starting and stopping of electrical apparatus. The leaflet shows the application of "tymit" to radios, refrigerators, oil burners and other types of heating devices. A supplementary quotation sheet carries prices for heating contractors and several suggested wiring diagrams for using the instruments with heating devices and electrical apparatus.

◆

308—Humidifier Leaflet

A four-page colored leaflet is announced by Monmouth Products Company, 201 East 131st Street, Cleveland, Ohio, covering the recently announced Automatic June Hydro-Metric humidifying system. The leaflet shows the humidistat, the water control valve, the pan type evaporator and presents a complete discussion of the operating principles of the system.

TESTED!

to Prove a 30 to 50% Greater Strength and Endurance.

Built of Vernalloy means built to last . . . to last easily 1½ times as long as ordinary cast iron, or, in other words, practically a lifetime . . . and only Vernois Furnaces are Vernalloy built. Thus, they give you a proven sales story that cannot for effectiveness be duplicated.

In Vernois Furnaces (THE HEAVIEST OF THEIR TYPE BUILT TODAY) you sell not only many labor and fuel saving exclusive features, but the proven fact that it must deliver many years of perfect, trouble-free and economical operation.

Convincing proof for you and your customers is now available, definitely showing Vernalloy's superiority by actual test. Write for our "Tested in a Hell on Earth" folder. It will convey to you the possibilities of the tremendous sales story behind Vernalloy and Vernois Furnaces.

All .Vernois Furnaces may be purchased on the Vernois Easy Payment Plan—3 years to pay at low interest rates.

MT. VERNON FURNACE & MANUFACTURING COMPANY

Mt. Vernon **Illinois**

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 69.

309—Andes Furnace Catalog

Andes Range and Furnace Corporation, Geneva, New York, announce catalog No. 35-8—a completely new presentation of the company's line of furnaces. The catalog contains illustrations, specifications and a presentation of the features of the BRN cast iron, return flue, radiator type furnace in sizes from 60,000 to 225,000 Btu per hour at an 8-pound combustion rate. Features of the furnace, such as the radiator, hot blast, fire pots and joints are covered in the catalog.

The company's type MDN cast iron furnace, with top ring radiator for round casings in sizes from 300 to 800 square inches of warm air leader pipe area, and the type MDN one-pipe or three-pipe furnace are covered by illustrations and sets of specifications. The catalog also shows the Andes room heater and the Andes air conditioning furnace, consisting of type BRN furnace with an air washer, filter section and blower attached at the rear for mechanical circulation. The new catalog also contains a condensed code to determine the size of the furnace, the size of the warm air pipes, the size of the wall stacks and size of the cold air return system.

◆

310—Repair Order Chart

The National Foundry & Furnace Company, Dayton, Ohio, announce that they are mailing to contractors purchasing repair parts or requesting catalogs a new chart which enables buyers to specify the various parts of a furnace by the correct name. The chart shows a furnace and all of its component parts with the proper names to be used in ordering parts. The chart is so designed that it can be hung on the wall or placed in the file for ready reference. Contractors wishing a chart to assist them in ordering parts may secure one by addressing the company.

◆

311—Furnace Leaflets

Two leaflets, describing the line of furnaces manufactured by the Thompson Manufacturing Company, 30th and Larimer Streets, Denver, Colorado, are announced by the manufacturer. The line of furnaces consists of gas heating units for houses of from four to nine rooms, also furnaces for coal burning only, and combination furnaces for coal and gas. The two-fuel furnaces are so designed that the change from coal to gas is quickly made by moving the burner lever. The change in fuel can be made without interrupting the operation for more than a few minutes and without changing the furnace in any way. All furnaces have rectangular steel bodies, housed in rectangular galvanized iron casings.

The standard steel furnace, consisting of a round drum and crescent-shaped radiator with cast iron front and housed in a circular galvanized iron casing, is presented in the second leaflet. The furnace is of customary construction with fire brick lining, grates designed to burn a variety of coal and manufactured in grate areas from 1½ to just over 5 square feet of surface. Heating capacity ranges from 463 to 1,280 square inches of leader pipe area.

◆

312—Knock-Down Fittings Leaflet

The A. G. Brauer Supply Company, St. Louis, Missouri, announces a small leaflet showing and describing the line of Ster-Na-Man "Knock-Down" fittings for smoke pipes. The fittings consist of standard centers, ends, caps and bands, so designed that angles, elbows and tees can be assembled from the same units. The leaflet shows and describes all of the units and illustrates typical installation practices.

CHECK these points on Nu-DRY Furnace Cement

Every one a profit maker for YOU

✓ **1** It comes to you in dry form.

✓ **2** It takes less material to set a furnace.

✓ **3** It does NOT CRACK or POWDER when furnace is FIRED IMMEDIATELY after applied.

✓ **4** It will not shrink.

✓ **5** It keeps joints tight at all times.

✓ **6** It stands high temperature.

✓ **7** It is not affected by temperature changes.

✓ **8** There is no loss because it will not get hard in containers.

Write Us for Prices and Name of Nearest Jobber

Pyrolite Products Co.

Refractory Engineers

1221-31 West 74th Street

CLEVELAND OHIO

NEW
NEW
NEW!

OF COURSE IT'S

ANOTHER
RYBOLT
FURNACE

GREATER
MORE SALABLE
MANY FEATURES

Watch for it next month in American Artisan. You cannot afford to miss it!

With the Manufacturers . . . .

Furblo Users Letter Contest

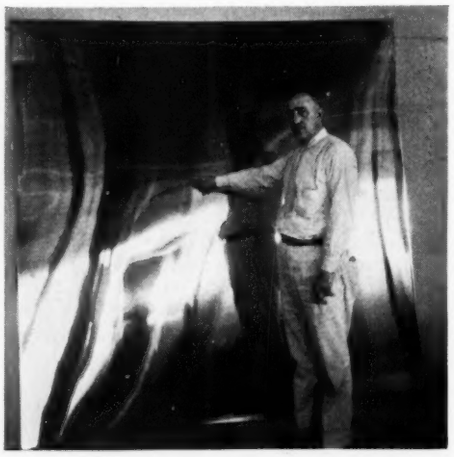
The Furblo Company, Hermansville, Michigan, announce a "Users Letter" contest for the purpose of gathering from all parts of the country enthusiastic letters setting forth the fuel saving, reduction of cleaning bills, uniform house heating, increased efficiency, immediate heat supply from a Furblo. These letters will be sorted and the best ones published in a booklet to be used by dealers as convincing proof of the advantages of forced air heating and Furblo.

First prize for the best letter will be a Series 50 unit; the next best 10 letters will each receive a $10 credit against a Furblo. Every Furblo dealer will get a copy of the testimonial letter booklet. The contest ends at noon, October 31, 1935. Full information on the contest can be obtained by writing Furblo for a contest leaflet.

◆

Largest Stainless Steel Sheet

When the American Rolling Mill Company made what they believe to be the largest stainless steel sheet ever manufactured, the photographer, when he developed his negative, found the mirror-like surface had picked up the images of the workmen who made it, and reflected them back into



the camera's lens. The camera man was given preferred attention and even the windows and roof of the building appear in the reflected photo.

The sheet is 84 by 90 inches, a giant as stainless steel sheets go. It is of 12 gauge, and carries a No. 7 polish. The huge sheet was on display at the National Metal Congress in Chicago, September 30th to October 5th.

◆

Richardson & Boynton Reorganizes

An order signed by Judge Henry W. Goddard of the United States District Court for the Southern District of New York, on September 13th, 1935, completed the final step in the reorganization of Richardson & Boynton Company. Under the plan approved by the court, all classes of creditors and stockholders were provided for equitably. Additional working capital has been supplied through a Federal Reserve Loan, part of which will go to former creditors.

Those close to the company are extremely optimistic over the future of the company. They point to its long and successful history of nearly one hundred years as a manufacturer of heating and cooking equipment. The fact that Richardson & Boynton Company is well established in both the boiler and warm air furnace industry is also important because of the increasing growth of air conditioning.

1937 will mark the one hundredth anniversary of Richardson & Boynton Company as a manufacturer of heating and cooking equipment—the oldest in the industry.

With the Manufacturers . .

Joliet Heating Corp. Announces Midwest Distributor

The Joliet Heating Corporation, Joliet, Illinois, announces the appointment of the Chicago Airtemp Corporation as distributors in thirty-six counties of Illinois, Indiana and Wisconsin. This organization is also the distributor of Chrysler air conditioning products and is in a position to give heating, ventilating and plumbing contractors complete service.

◆

C. H. Quirk Joins Trane

Clinton H. Quirk, for many years connected with the Vento Division of the American Radiator Company, has joined the staff of The Trane Company, manufacturers of Heating and Air Conditioning Equipment, La Crosse, Wisconsin.

Mr. Quirk will be active throughout the Eastern territory. His activities will cover the entire Trane Line and he will act in an advisory capacity to branch offices, architects, engineers and owners.

◆

Inland-Ryerson Reorganization

At the special stockholders' meeting of Inland Steel Company held September 20, the plan of reorganization to effectuate the union of the business of Inland Steel Company with that of Joseph T. Ryerson & Son, Inc., was approved.

The charter was amended by increasing the authorized no par value shares from 1,200,000 to 1,600,000, of which 240,000 shares were authorized to be issued for the acquisition of all of the assets, business and good will of the Ryerson Company.

Edward L. Ryerson, Jr., Joseph T. Ryerson and Everett D. Graff were added to the Board of Directors of Inland Steel Company. J. H. Morris was also elected a director.

"Herb" Symonds Dies

"Herb" W. Symonds, president of the Symonds Register Company, St. Louis, Missouri, died Monday, August 19. Mr. Symonds for many years was one of the most active members of the register manufacturing industry and a very well known figure in all heating circles. Over a period of many years Mr. Symonds was a familiar figure at all state, national and local association meetings throughout the country.

◆

Penn Electric Switch Appoints Burton E. Shaw

Penn Electric Switch Company, Des Moines, Iowa, announces the appointment of Burton E. Shaw as chief of the research department, effective August 1. Mr. Shaw served as sales engineer with the Penn Electric Switch Company for some time prior to his new appointment.

FOR YOUR CONVENIENCE

American Artisan, 6 N. Michigan Ave., Chicago, Ill.

Please ask the manufacturer to send me more information about the equipment mentioned under the following reference numbers in "New Products" and "New Literature." (Check numbers in which you are interested):

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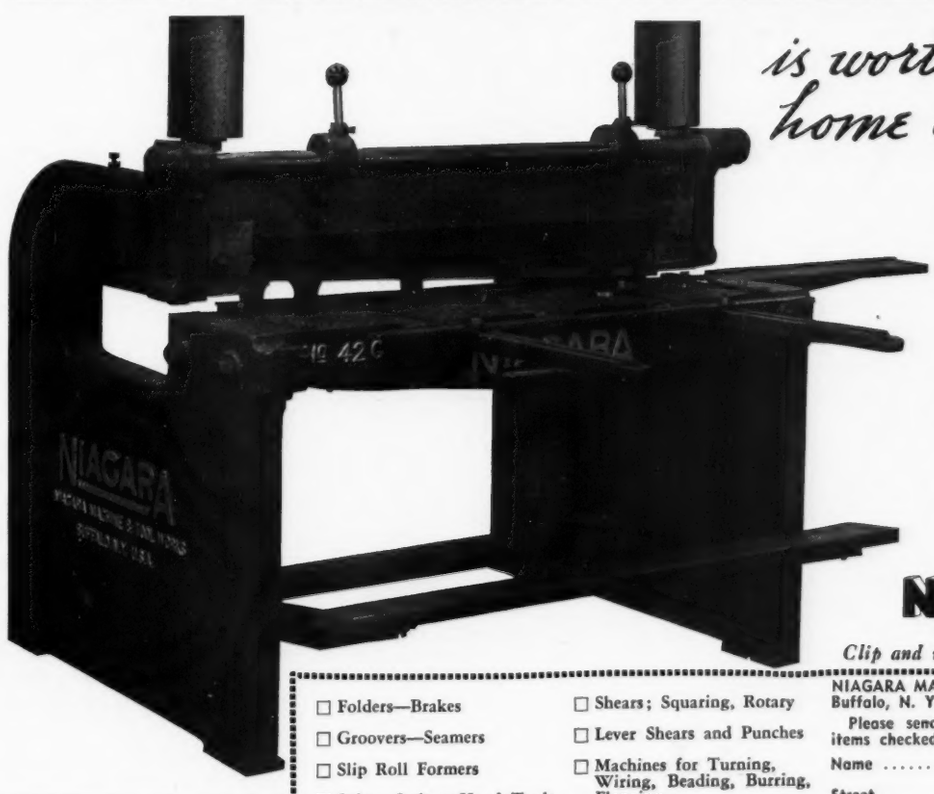
This new NIAGARA Foot Operated Shear



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NIAGARA MACHINE & TOOL WORKS A-A-10
Buffalo, N. Y.

Please send data on Foot Gap Shear and other items checked.

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Street ..... City .....

Warm Air Fan-Heating

(*Continued from page* 19)

tion. Even if such a plant is a recommendation, he may feel that such heaters are not applicable to large work.

Direct Fired Heaters

There are many different methods for "setting" direct fired heaters when used in connection with the fan system. Several such settings are shown on the accompanying cuts. Fig. 1 shows the simplest method.

Where air is heated in large volumes and forced into spaces where a considerable area is heated, such as factories, garages, warehouses, dance halls, and large auditoriums, no method is required for tempering the air, so room temperatures must be controlled by the governing of the fire. Ordinarily, where large volumes of air are heated in this manner, the room temperature remains fairly constant, and with a little experience the fireman, by watching the plenum chamber thermometer installed in the wall of the heating chamber, can maintain fairly even room temperatures.

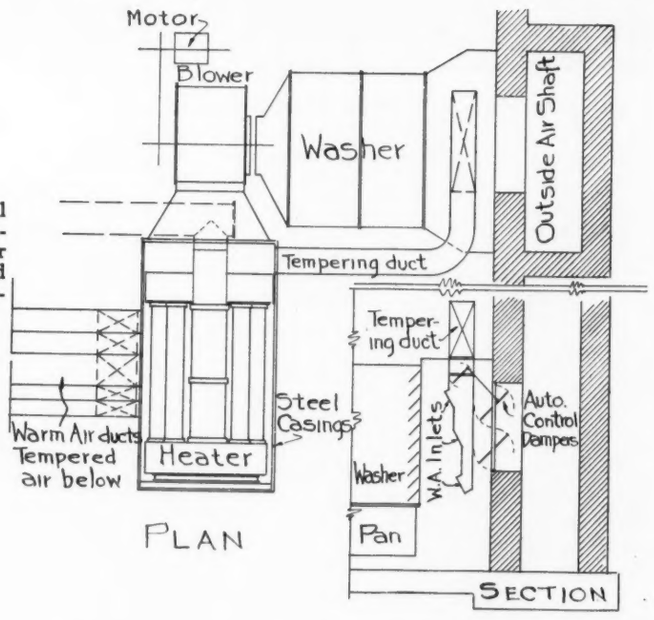

Fig. 4. — Typical hookup of fan-furnace - washer showing method of tempering outside air.

Fig. 2 shows a double deck or "over shot" system. With this method a tempered air chamber is provided over the warm air plenum. A temperature of 60 to 70 degrees is maintained in the tempered air chamber and is supplied with either cool air or heated air, or both, through a by-pass. The temperature is regulated by a double mixing damper that may

(*Continued on page* 72)

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FURNACE VACUUM
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A One-Man Super Powered Machine

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F. O. B. Cincinnati with Tools and Attachments.

This is the same high quality machine that is known to furnace dealers everywhere as the most powerful, one-man cleaner on the market. Built by practical furnace men.

Quantity production and large purchasing power enable us to make this sensationally low price. Includes tools and attachments. Folder "A" mailed upon request.

We also manufacture the "Christie Giant" to operate from truck or yard.

Sold by Jobbers and Furnace Manufacturers. Write for names of those in your territory.

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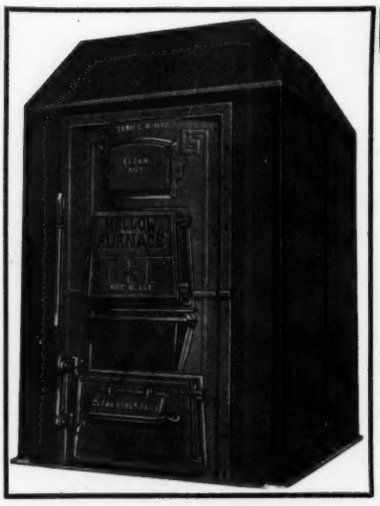
Division of The Cincinnati Sheet Metal & Roofing Co.

226-30 East Front St. Cincinnati, Ohio

Salesmen: A few choice territories still open.



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If you are interested in a line of furnaces that will bring you new business, write us today for prices and complete information.

LIBERTY FOUNDRY COMPANY
St. Louis, Missouri

Also Manufacturers of
FRONT RANK HEATING SYSTEMS

New Literature . . . .

For your convenience in obtaining copies of new Literature, use the coupon on page 69.

313—Special Air Conditioning Section

Within the next few years it is inevitable that year-round air conditioning for homes will become as commonplace and indispensable as the modern heating plant is today. This is the conclusion expressed by the editors of House & Garden in a twelve-page special section on Air Conditioning in the August issue.

Debunking the false "air-conditioners" with which the public has been fooled during the past few years, a complete discussion of the subject for the layman serves as an important step toward giving the public an understanding of air conditioning values.

The seven virtues of air conditioning are defined as heating, humidification, cooling, dehumidification, air cleaning, air motion and automatic control. Reports of some of the scientific tests made of actual installations show how the millions of dollars being poured into pure research are the public's best guarantee of air-conditioned satisfaction.

◆

314—Register and Grille Catalog

Register and Grille Manufacturing Company, Incorporated, 70 Berry Street, Brooklyn, New York, announce a new catalog No. 30 covering the company's line of ornamental grilles for heating and ventilating systems, both cast and stamped, plain type grilles for heating and ventilating, special designed grilles of stamped materials and a line of forced air heating or ventilating registers with adjustable louvres and blades. Each of the products is shown by means of illustration, accompanied by tables giving full specifications of sizes, holes, free area, etc.

◆

315—Stainless Steel Handbook

Crucible Steel Company of America, 405 Lexington Avenue, New York City, announce the compilation of a booklet covering the corrosion and heat resisting qualities of stainless steel. The booklet is thoroughly illustrated with photographs showing typical applications of stainless steels for architectural ornamentation, tanks, trucks, industrial service apparatus, etc. Text matter covers the resistance of the metal to various types of corrosive agents. Valuable tables giving the reaction of stainless steel to all kinds of industrial acids, brines and liquids are presented in the forepart of the book. Additional information covers the general qualities of strength, resistance to abrasion, appearance, resistance to scaling and heat, etc. The latter part of the book covers the general working and fabricating properties; such as, forging, annealing, pickling, forming and drawing, grinding and polishing, riveting, welding and the reaction of stainless steel to the ordinary sheet metal shop equipment.

◆

316—Mailing Postcard

The Furblo Company, Hermansville, Michigan, announce that they will supply contractors, making proper arrangements, with cards entitled "Was Your House Warm When You Got Up This Morning?" The text on the card explained how a house can be heated up more quickly, evenly and more comfortably by the application of a mechanical air circulator. The advantages of cleaning are also emphasized. The card states that a blower unit is one of the products which may be obtained through FHA financing.

◆

317—Boiler and Furnace Repairs Catalog

The National Foundry and Furnace Company, Dayton, Ohio, announce price list No. 23 covering repairs for furnaces and boilers. The catalog lists repair parts for all of the better known furnaces and boilers as well as numerous furnaces and boilers now out of manufacture. The various items for each unit, which the company keeps in stock, as well as current prices are shown in the catalog.

SEND FOR NEW CATALOGUE!

IT'S a fitting book for CAPITOL . . . it contains everything for efficient furnace repairs . . . it proves our slogan . . .

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SHEET METAL CONSTRUCTION
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More store fronts, interiors, ornamental work and other phases of sheet metal construction are in use today than ever before. This steady increase in the use of sheet metal construction increases greatly the value of the VIKING Portable Bench Shear to the sheet metal contractor.

This shear which is portable and can be carried to the job is saving much time and cutting labor costs for many sheet metal contractors.

Write for full particulars.

VIKING SHEAR CO.
ERIE PA.

The VIKING *Shear*

be operated manually or by a thermostat and damper motor.

The warm air supply ducts are connected to the warm air plenum and the tempered air chamber by a fitting termed a "mixing box," which contains a double mixing damper automatically operated from the room supplied. This is a highly successful method and ideal where the necessary head room is available.

Where such head room is not obtainable, the tempered air chamber may be located at the rear, or at the sides of the warm air chamber. This system is termed the "under shot" plan and is shown in Fig. 3.

Where air washers are used in conjunction with direct fired heaters, they may be arranged as shown in Fig. 4. Where all outside air is used, it is necessary to temper the air before it passes through the washer or freezing will result in zero weather. A warm air duct is run from the plenum chamber back to the air intake in front of the washer. The outside air chamber must be provided with a thermostat to operate the dampers shown in Fig. 4 (section detail). The warm air duct will open, closing the outside air dampers whenever the temperature in the outside air chamber drops below 40 degrees. These dampers should be of the gradual action type so that the outside air and warm air from the plenum may mix. It is necessary to increase our total c.f.m. slightly to compensate for the air that returns to the intake from the plenum chamber.

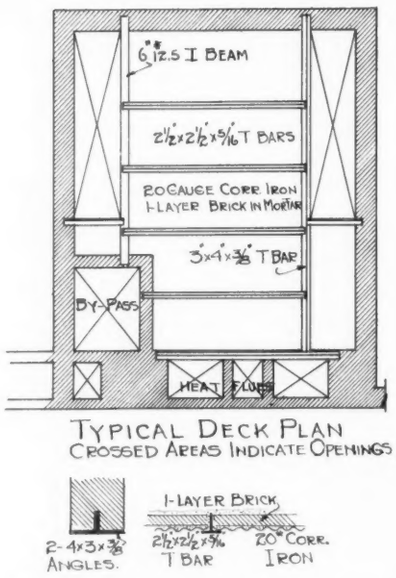


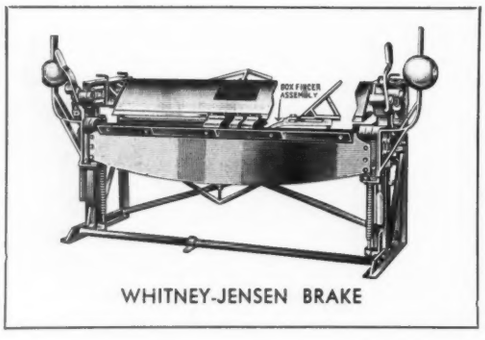
Fig. 5—Details of a typical deck above the warm air plenum for a narrow heater.

Where all the air is recirculated, it is necessary to provide an outside air supply to lower the temperature of the air passing through the washer or the building will become over-humidified. The control dampers are the same as shown in Fig. 4 except that the warm and cold tempering air are the reverse of those shown.

Direct-fired heaters may be cased in brick walls or sheet metal casings. Where heaters are brick-set, the brick work is generally done by the general contractor. However, the heating contractor must furnish the lintels, deck iron, manhole doors and sleeves for warm air openings.

A typical deck plan is shown in Fig. 5. This is the upper deck above the warm air plenum for the heaters.

If the lintels span 8 feet or over, they must be heavy enough to carry the wall above.



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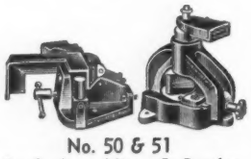

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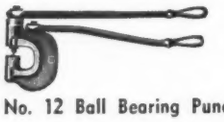

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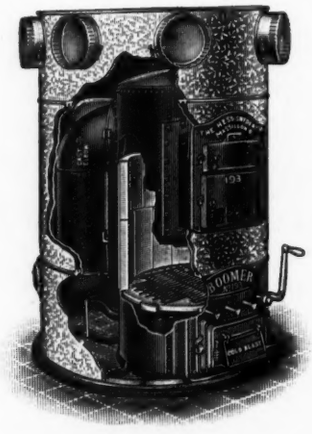

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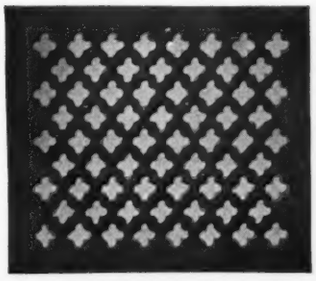

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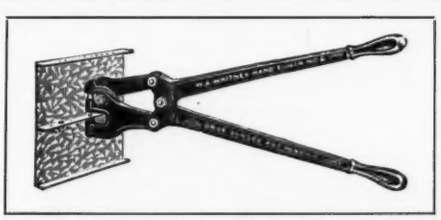

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Costs homeowners far less—hence has a far bigger market; pays you a far bigger profit—about $10 an hour for labor. As available as your nearest jobber, as easy to handle as putty, and so far superior to anything known before that it is changing heating practice everywhere. Here is opportunity for sales and profits, a chance in a lifetime you should check into.

START NOW

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Send FREE Sample! and full information.

Signed .....

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Senate Office Building Copper Work

(*Continued from page* 15)

½ inch over the screw heads. The free end of the cleat was turned over sufficiently to engage the edge of the sheet, and was locked into the seam.

Tens, and tens of thousands of holes were drilled in the solid concrete in which were inserted lead anchors for fastening the cleats. Drilling was mechanically done with especial care taken that the holes were not materially larger than required to receive and make thoroughly tight the expansion anchors.

Considerable difficulty was experienced in making the anchors hold. After experimenting it was found the trouble was due to not cleaning out the drilled holes. The fine powder that remained acted very similar to salve, allowing the lead no hold. A tire pump was thereafter used to blow out the dirt.

Two inspectors were continuously on the job—Mr. Kelly, for forty-one years a sheet metal worker and for fifteen years with the Government, and his assistant. Every cleat was tested with a pair of pliers and subjected to pressure before it was passed. Those cleats which came loose meant new holes had to be drilled.

Flat seams were provided with ⅝-inch lock. The roofing was applied the narrow way, joints staggered, using sheets 18 inches by 24 inches. All sheets were properly notched and bent to form flat seams. Sheets were locked and soldered together in long lengths, like tin, and laid on the roof with cleats on the long side only, spaced 8 inches on centers.

Expansion joints 1½ inches high were provided every 14 feet on centers.

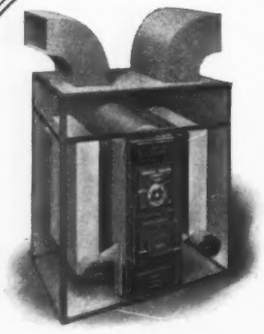
Expansion Joints

Expansion joints were installed not only every 14 feet on centers, and at the high points of the gutter, but also running along the middle of the gutter and along the ridge of the flat seam roof.

The joint was made very similar to the standing seam on a standing seam tin roof with the two exceptions that they were slightly higher, and that they were soldered at the lock. This lock makes for rigidity. The joint is not so easily mashed should someone step on it. The joint is not cleated in the middle, but on the edges.

All seams throughout the work that required soldering had the edges of the sheets on both sides tinned 1½ inches back. Cleats used where seams were soldered were also tinned. The tinning was done in our plant.

Edges of copper after tinning were thoroughly cleaned with a strong solution of caustic soda (4



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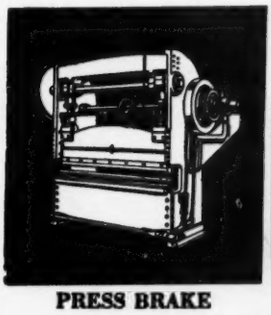

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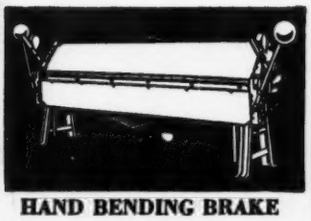

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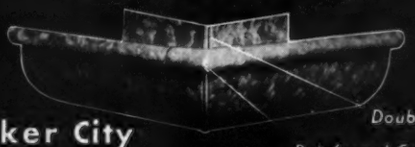

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to 6 oz. per gallon) in warm water. After this solution was applied, the edges were washed off with clean water and then wiped clean.

A section of the old flat seam copper roofing taken from the roof was a wonderful lesson in incorrect cleating. The cleats not having been tinned did not flux into the seam and when not well soldered on the outside surface left an opening for the passage of water. Samples taken from the senate roof forcefully convinces one of the danger of this error.

Battens

Wood battens consisted of 2 by 3-inch dressed, beveled, best-grade long leaf yellow pine. They were free from loose knots and thoroughly saturated with creosote under pressure before being laid. The battens were spaced approximately 20 inches on centers to accommodate the adjoining sheets.

Battens were fastened to the roof with ¼-inch diameter, brass, round-head machine screws 2½ inches long set in expansion anchors spaced approximately 2 feet on centers. Heads were countersunk ⅜-inch down and provided with brass washers. The copper sheets, 24 inches by 96 inches were turned against the battens, capped and locked. The horizontal joints were sealed with whitelead.

Batten Ends

The batten ends were enclosed with a folded piece of copper (see illustrations). This method was developed by Mr. Kelly after four or five years of experimenting. Its features are that (1) no solder is required (2) it permits ample opportunity for expansion and contraction (3) is readily installed (4) and is neat in appearance. Mr. Kelly contends—"the more solder you can keep off a copper roof the better off you are. The longer it will stand."

Batten Caps

The batten caps were formed from strip copper, but this medium is not advised as the copper in rolls tends to swerve and be irregular. There is a lost motion in trimming and straightening. Sheet copper, though more expensive, is recommended.

Cleats used in connection with battens passed under the batten, turned up, and then locked the metal.

No killed muriatic acid was used. The flux was a non-corroding commercial liquid.

Hips were formed similar to battens with neatly fitted-batten joints where battens mitered into same. They were slightly higher than the regular battens.

New sleeves of 20-oz. copper for the drains were originally called for, but this was changed to 16-oz. copper to avoid trouble in expansion and contraction where the two different weight materials joined. Lake copper was used for both flat seam and batten roofs.

Hoisting

Materials were raised to the attic by an elevator, then passed through a scuttle hole. A hand pully erected on a roof scaffolding in a corner of the inner court was also used.

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Minneapolis Code

(*Continued from page 22*)

special permission may be granted by the Inspector of Buildings to use such lower temperature for design purposes, as conditions may warrant.

Section 203. Coefficients of Heat Transmission for Various Types of Wall, Floor, Ceiling and Roof Construction: For the purposes of this ordinance, in estimating the heat required for warming buildings, the coefficients of heat transmission to be employed, for various types of wall, floor, ceiling and roof construction, and for doors, windows and skylights, shall be as set forth in Chapter 5, Volume 13, American Society of Heating and Ventilating Engineers Guide, 1935 edition, or as hereinafter provided for in this section.

Coefficients of heat transmission to be used, under the provisions of this ordinance, for any types of wall, roof, ceiling or floor construction not set forth in the preceding tables shall in each such case be determined by the Department of Buildings.

Section 204. Infiltration: For the purposes of this ordinance, in estimating the heat required for warming buildings, the infiltration in cubic feet per hour per lineal foot of crack, and the B.t.u.'s per hour per lineal foot of crack required, for various types of windows and doors, shall be as set forth in Chapter 6, Volume 13, American Society of Heating and Ventilating Engineers Guide, 1935 edition.

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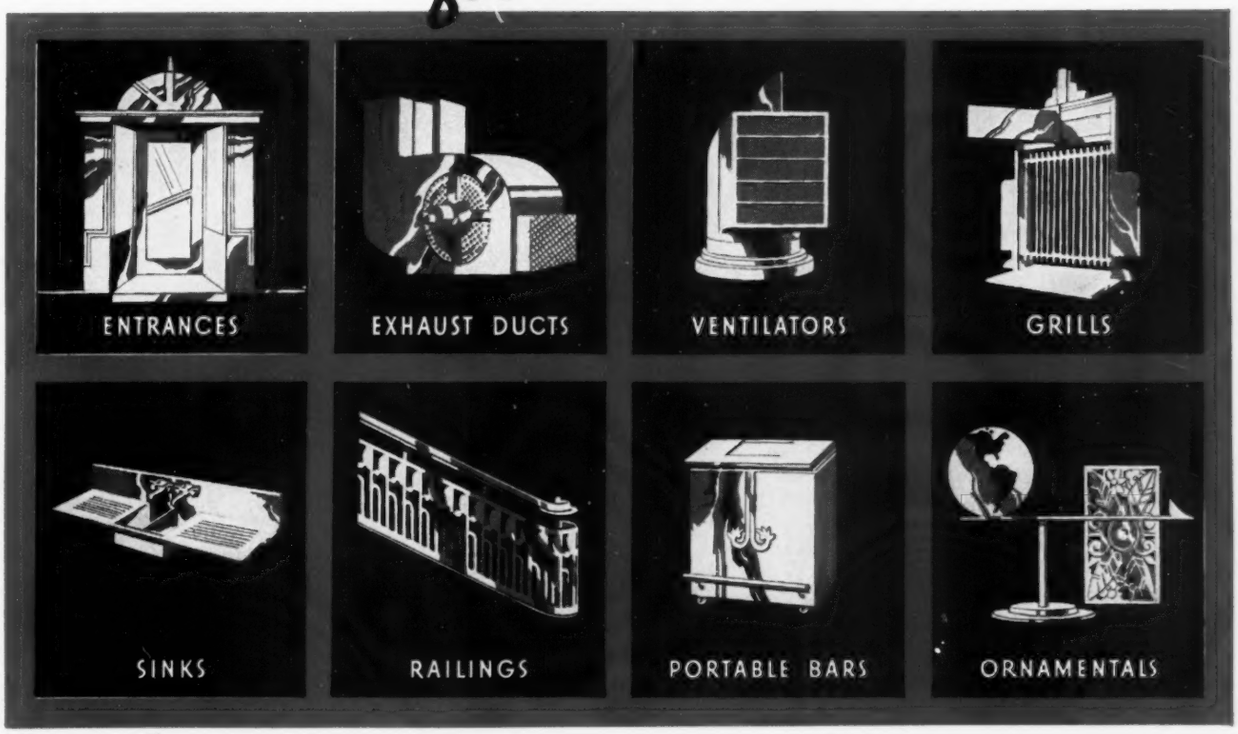

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